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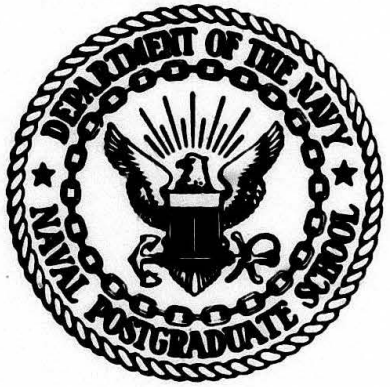

(6) TEMPERATURE DEPENDENCE OF GAS PROPERTIES IN POLYNOMIAL FORM

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ABSTRACT

Based on a least-squares polynomial approximation, a procedure is introduced for calculating existing tabular values of thermodynamic and transport properties for common gases. The specific heat at constant pressure is given for 238 gases, the thermal conductivity for 55 gases, the dynamic viscosity for 58 gases, and the second and third virial coefficients for 14 gases. At sufficiently low pressures, ideal gas behavior previals and temperature may be used as the single independent variable. The algorithm for nested multiplication is presented, optimized for hand-held or desktop electronic calculators. Using the polynomial approximations and a suitable calculator, it is possible to duplicate existing reference source tabular values directly, obviating the need for interpolation or further reference to the tables per se. The accuracy of the calculated values can be within 0.5% of the tabular values. The polynomial coefficients are given in the International System of Units (SI). Methods are presented to calculate the temperature corresponding to a given property value. Extrapolation features of the polynomials are discussed.

TABLE OF CONTENTS

I. INTRODUCTION

Many important thermodynamic and transport properties of gaseous elements and compounds can be expressed purely and accurately as functions of temperature. The perfect gas behavior of simple compressible substances is a well documented example[1-3]. Data tables for such single-variable functions may be approximated with curve-fitting techniques reducing the tabular information to polynomial or exponential forms. Given these equations and a handheld or desktop electronic calculator, a user may retrieve the tabular information accurately and conviniently without interpolation or further reference to the original data sources. The objective of this work is to provide sufficiently simple polynomial fits which together with a modern electronic calculator present the most convinient method of handling the calculation of thermodynamic properties accurately. In all but the most detailed numerical work, the information presented here should prove to be advantageous over present tabular, graphical, or other methods. This report significantly expands the scope of our earlier work[4] by including basic properties of a large number of elements and compounds.

The gas properties for which polynomial equations are presented comprise the specific heat at constant pressure [$C_p(T)$] for 238 gases in Appendix A, the thermal conductivity [$k(T)$] for 55 gases in Appendix B, the dynamic viscosity [$\mu(T)$] for 58 gases in Appendix C, and the second and third virial coefficients for 14 gases in Appendix D. The accuracy of reproduction of source data is within 0.5%. The correlating equations are presented in the International System of Units (SI). To further enhance the usefulness of this work, methods are given to reverse the dependent and independent variables (i.e., to calculate the temperature corresponding to a given property

value); these methods consist of either polynomials for the inverse calculation as given in the Appendixes or the iterative procedures discussed in Section 5.

In any effort such as this, consideration must be given to the range of validity of the polynomial fit in addition to its accuracy. Section 2 addresses these important topics. The possibility and limitation of extrapolation is discussed in Section 4. Also, the technique of nested multiplication is discussed in Section 3; this technique is a "natural" for the majority of electronic calculators presently available and provides for the convinient use of the information presented herein.

It should be noted that for a perfect or ideal gas (with variable heat capacities) having C_p in polynomial form is particularly useful. This is because the polynomials may be integrated easily, without risking any decrease in the accuracy of the results. The well known relations for a perfect or ideal gas are summarized below and Ref. 5 expands on the technique for generating the gas tables.

$C_v = C_p - R$ [specific heat at constant volume]

$\gamma = C_p/(C_p - R)$ [ratio of heat capacities]

$h = \int C_p dT$ [enthalphy]

$u = h - RT$ [internal energy]

$\phi = \int C_p \frac{dT}{T}$ [entropy function]

While the simplicity and utility of the perfect or ideal gas calculations is readily apparent, imperfect or real gas behavior is also important. In the Appendixes, therefore, two headings are often found, i.e., ideal gas and real gas. We also include in this work polynomial fits for the second

and third virial coefficients. These allow accurate representation of non-ideal behavior at densities as high as 0.7 of the critical value[6].

The material in this report is intended to be used in conjunction with standard reference texts on thermodynamics, fluid dynamics, and heat transfer. The user is encouraged, moreover, to discover for himself how the simple polynomial fits aid in the handling of differential equations with variable coefficients.

II. POLYNOMIAL CURVE FITS

The data source for Appendixes A, B, and C is the TRPC[7-9] series. The virial coefficients are found in the American Institute of Physics Handbook, 3rd Edition[10]. These sources are considered to be among the most accurate. The TPRC series reproduce a large number of original sources and present a critically evaluated consolidation of available data. The accuracy of duplication of reference-source values is included with the polynomial equations as part of the format in the Appendixes [see pp. A-viii, B-iii, C-iii, and Dii]. References 7-9 include their own third-degree polynomial fits; other polynomial expressions are also available[11,12] in most thermodynamic textbooks.

The most important consideration given in the curve fitting is the reliability of the data. Next to reliability, consideration is given to the greatest possible temperature range; reference source data are split along temperature intervals to achieve the most acceptable duplication accuracy. The equations presented are the lowest degree equations which achieve the desired accuracy over the temperature range stated.

III. POLYNOMIAL EVALUATIONS

For the calculation of properties or the inverse calculation of the temperature, we have relied almost exclusively on polynomial fits, with the exception of some specific heat [$C_p(T)$] forms which are exponential. The equations presented have the following forms:

Polynomial

$$FCTN(T) = B(0)+B(1)T+B(2)T^2+\ldots B(N)T^N = \sum_{m=0}^{N} B(m)T^m$$

Exponential

$$\ell n[FCTN(T)] = B(0)+B(1)T+\ldots B(N)T^N = \sum_{m=0}^{N} B(m)T^m$$

$$[\text{e.g.,}\quad C_p(T) = (\text{const})\ \exp\left[\sum_{m=0}^{N} B(m)T^m\right]$$

The most efficient method of evaluating single-variable polynomials is "nested multiplication"[13]. Nested multiplication eliminates the need to raise "X" to the "Y" power and simplifies an N-th order polynomial evaluation to a sequence of multiplication/addition steps. Examples of nested multiplication are presented below.

A. Generalized Nested Multiplication Algorithm:

Given the N coefficients, B(0), B(1), B(2), ... B(N), for the polynomial function FCTN(T) and any value of the temperature "T_i" within the range of validity

Set A(N) = B(N) [e.g., A(6) = B(6)]

For K = N, N-1,N-2, ... 1, Do

Set A(K-1) = B(K-1) + T_iA(K)

A(0) = FCTN(T_i)

The above algorithm may be stated in words as follows: multiply the highest degree coefficient by the temperature value, T_i, and add to the next lower degree coefficient; multiply the sum by T_i and add to the next lower degree coefficient; multiply the sum by T_i ... Continue the process until the sum $B(1)+A(2)T_i$ is calculated; multiply this sum by T_i. By just adding the B(0) coefficient to the previous product, the polynomial evaluation is completed for the chosen value of T_i.

B. Specific Example of Nested Multiplication:

Consider the calculation of the specific heat at constant pressure $[C_p(T)]$ for carbon dioxide (CO_2), ideal gas, at 800°K. From page A-9,

$$C_p(T) = 453.86462 + 1.5334795T - 4.195556E\text{ -}04\ T^2 - 1.871946E\text{ - }06T^3 + 2.862388E\text{ -}09\ T^4 - 1.6962E\text{ - }12\ T^5 + 3.717285E\text{ - }16\ T^6$$

Set A(6) = 3.717285E-16 ; T = 800

Step-by-Step Procedures			Calculated Values	A(N)
(1)	3.717285E-16	B(6) =	3.717285E-16	A(6)
(2)	X800	XT_i	2.973828E-13	
(3)	-1.6962E-12	+B(5)	-1.3988172E-12	A(5)
(4)	X800	XT_i	-1.11905376E-09	
(5)	+2.862388E-09	+B(4)	1.74333424E-09	A(4)
(6)	X800	XT_i	1.394667392E-06	
(7)	-1.871946E-06	+B(3)	-4.77278608E-07	A(3)
(8)	X800	XT_i	-3.818228864E-04	
(9)	-4.195556E-04	+B(2)	-8.013784864E-04	A(2)
(10)	X800	XT_i	-0.641102789	
(11)	+1.5334795	+B(1)	0.892376711	A(1)
(12)	X800	XT_i	713.9013687	
(13)	+453.86462	+B(0)	1167.765989	A(0)

Rounding to two decimal places, $A(0) = C_p(800K) = 1167.77$ J/Kg K.

For programmable calculators, nested multiplication is extremely efficient and highly recommended. To preserve the add-multiply-add simplicity, negative coefficients should be stored as negative values.

IV. EXTRAPOLATION

With each polynomial equation there is a specified range of validity and an associated error estimate. The stated temperature range corresponds to that of the reference source. It is often highly desirable to know how the given polynomial expressions extrapolate. A limited polynomial extrapolation beyond the specified temperature range may often be possible but in indiscriminate extrapolation the accuracy will most likely suffer. In fact, polynomial fits are notoriously bad for certain type of curves outside of their specified range.

Clearly, it is inappropriate to look at every possible type of variation. Suffice it to say that for reasonably smooth, monotonic functions such as the viscosity, the thermal conductivity, and perhaps the heat capacity of polyatomic molecules, the polynomial fits will follow with some fidelity the trends outside of their specified range. If is anticipated that the heat capacity of diatomic molecules will be the most difficult for the polynomials to follow because of the "stepwise" nature of the curves[14,15]. We have chosen to present the heat capacity of nitrogen as an example. The ideal gas polynomial fits are given on pg. A-41; we choose the curve for the temperature range 590-1365°K. As the basis of comparison, we pick the theoretical[14] curve which represents the activation of the vibrational mode of the nitrogen molecule, using θ_v = 3390°K. Table I shows a listing of these calculations. It is seen that the polynomial results are within an acceptable $\pm$0.5% for the temperature range 500°K to 1600°K. Above and below this range the polynomial results quickly diverge as more or less anticipated. Certainly, a useful rule may be to stay within 100°K of the guaranteed range.

TABLE I

POLYNOMIAL COMPARISON, C_p FOR NITROGEN

T (K)	CP/R THEO	CP/R POLY	%DIFF
400	3.51513	3.55253	-1.06371
500	3.55272	3.56516	- .35014
600	3.6137	3.62092	- .199842
700	3.68868	3.69739	- .236274
800	3.76795	3.77981	- .314853
900	3.84486	3.85952	- .381236
1000	3.91588	3.9325	- .424339
1100	3.97859	3.99775	- .456325
1200	4.03582	4.05591	- .497772
1300	4.08501	4.10757	- .552173
1400	4.12787	4.15159	- .574591
1500	4.16518	4.18432	- .45953
1600	4.19768	4.19665	.024718
1700	4.22606	4.17417	1.22786
1800	4.2509	4.09448	3.67977

The reader might ask at this point why bother with a polynomial when an exact expression is available. The answer to this question is two-fold: First, reliable analytical expressions are not available for most of the properties and, second, when available they tend to be much more cumbersome than the polynomial expressions presented here.

V. ITERATIVE METHODS

It is often necessary to calculate the temperature from the known value of a property. This inverse problem is handled two ways, either a polynomial fit is given in Appendixes A, B, and C for the calculation of the absolute temperature as a function of the property or an iterative procedure is suggested. In this section we discuss such iterative methods.

Before proceeding, however, it is worth noting that when a second degree polynomials in T is given for the inverse calculation, the quadratic formula may be applied. If it works, this is by far the quickest way to a solution.

The polynomials presented have the absolute temperature (T) as the single independent variable and the property value (PV) as the dependent variable. FCTN (T_i) becomes the magnitude of the property value (PV) when the polynomial function is evaluated at $T = T_i$. Thus, FCTN (T_i) = |PV| at $T = T_i$. To enhance the usefulness of this work, three methods are provided for the calculation of temperature (T) as a function of a known or given property value, PV . The methods are (A) secant method, (B) Newton's method, and (C) fixed point iteration[16]. All three methods are iterative in nature.

The general form of the polynomials is

$$\text{FCTN } (T_i) = B(0) + B(1)T_i + B(2)T_i^2 \ldots B(N)T_i^N$$

The iterative methods attempt to solve for the approximate root (the temperature) of the equation of the form

$$F(T_i) = PV - B(0) - B(1)T_i - B(2)T_i^2 \ldots - B(N)T_i^N = 0$$

All of the polynomials are both continuous and continuously differientiable over the temperature intervals specified. Although these conditions are necessary for iterative methods to converge to an approximate root,

they are not necessarily sufficient in all cases to assure convergence. Enough testing has been done with the polynomials presented, however, to given reasonable assurance of convergence with any of the three methods discussed.

The quadratic formula for the second degree polynomial is simply

$$T = \frac{-B(1) + \sqrt{B(1)^2 - 4\,B(2)[B(0) - PV]}}{2\,B(2)}$$

A. Secant or Interpolation Method[13,16]:

When it converges, the secant method does so very rapidly, generally more rapidly than either of the other two iterative methods discussed. Two initial values (guesses) for the temperature are required, T_{-1} and T_0 . The initial temperature values selected may be the extremes of the valid temperature range noted with the polynomial sets.

Algorithm: Given $(T_i) = 0$ and two (2) initial points, T_{-1} and T_0

For $n = 0, 1, 2, \ldots$ until satisfied, do

Calculate $T_{n+1} = T_n - F(T_n) \dfrac{(T_n - T_{n-1})}{F(T_n) - F(T_{n-1})}$

In the special case when second degree polynomials given in the Appendix, the secant method algorithm reduces to:

For $n = 0, 1, 2, \ldots$ until satisfied, do

Calculate $T_{n+1} = T_n - \dfrac{B(0) + B(1)T_n + B(2)T_n^2 - (PV)}{B(1) + B(2)(T_n + T_{n-1})}$

Specific Example: Consider a second (2nd) degree polynomial for $C_p(T)$: $FCTN\ (T_i) = 0.232829 + 1.43429E\text{-}05T_i + 3.56638E\text{-}09T_i^2$. Assume a given property value $C_p = 0.2567$ but the temperature is unknown. The

known property value (PV) is 0.2567 and T_{-1} and T_0 are chosen arbitrarily at 200 and 2400 respectively. The following solution is provided:

n	T_{n-1}	T_n	T_{n+1}	
0	200	2400	-	
1	2400	2400	1411.67	
2	2400	1411.67	1286.97	
3	1411.67	1286.97	1266.32	
4	1286.97	1266.32	1265.87	
5	1266.32	1265.87	1265.87*	Convergence

$T_i = 1265.87$ for $C_p(T_i) = 0.2567$

B. Newton's Method[16]:

Newton's method requires a single initial value for temperature, T_0 , and the first derivative of the polynomial function, $F(T_i) = 0$. Newton's method tends to be sensitive to the T_0 selection, the closer T_0 is to the root, T_i , the more rapid it converges. For the polynomials presented, Newton's method generally converges without problems. It is recommended that the initial temperature value, T_0 , be selected mid-range between the polynomial valid temperature limits.

Algorithm: Given $F(T_i) = 0$ and a starting value, T_0

For n = 0, 1, 2, ... until satisfied, do

Calculate $T_{n+1} = T_n - F(T_n)/F'(T_n)$

For the special case of using a second degree polynomial from Appendix A, Newton's method reduces to the following:

For n = 0, 1, 2, ... until satisfied, do

Calculate $$T_{n+1} = T_n - \frac{B(0) - (PV) + B(1)T_n + B(2)T_n^2}{B(1) + 2B(2)T_n}$$

C) Fixed Point Iteration:[16]

Fixed point iteration tends to converge the slowest of the three methods discussed. It does, however, provide the user with the function definition. Given the function, $F(T_i) = 0$, the user defines an iterative function, $T = g(T_i)$, such that the solution of the iterative function is also the solution to $F(T_i) = 0$.

Example: Given $F(T_i) = 0 = B(0) + B(1)T_i + B(2)T_i^2 - (PV)$

$$\text{Then} \quad T_i = g_i(T) = \frac{(PV) - B(2)T_i^2 - B(0)}{B(1)}$$

$$\text{Or} \quad T_i = \left(\frac{(PV) - B(0) - B(1)T_i}{B(2)}\right)^{1/2}$$

Algorithm: Given $F(T_i) = 0$, a derived iterative function $g(T)$, and a single starting point, T_0

For $n = 0, 1, 2, \ldots$ until satisfied, do

Calculate $T_{n+1} = g(T_n)$

VI. CONCLUSIONS

Within the constraints of a single independent variable (the absolute temperature), it is possible to calculate thermodynamic and transport properties of a large variety of gases accurately. The accuracy of the polynomial results is generally within $\pm 0.5\%$ of the original tabular data. Since interpolation is "build-in", the effort is often no more time consumming than that of reading conventional tabular forms. The inverse problem, namely that of finding the temperature corresponding to a given property, can also be accurately carried out with the information given in this report.

Extrapolation beyond the established valid temperature range is possible but the accuracy of duplication of the property is dubious and cannot be quantified in most cases. The polynomials, however, do allow for a convinient "first guess" in most instances.

It is believed that the combination of simple polynomial representations with the technique of nested multiplication utilized in a modern electronic calculator will make the Gas Tables and other standard works obsolete in form. Integration and differentiation of the polynomials is, moreover, straightforward and virtually risk free so that they are attractive forms for numerical work, particularly with ideal gases. The advantages of simple polynomial representations become vividly clear when other correlation-equation forms are used, see for example the form of the viscosity given in Ref. 5 or 17.

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APPENDIX A
TABLE A-I
SUMMARY OF CONTENTS

SPECIFIC HEAT AT CONSTANT PRESSURE
FOR GASEOUS ELEMENTS AND COMPOUNDS

NAME	FORMULA	AT.WT/ MOL WT	GAS CONST	APP A PAGE
Acetone	C_3H_6O	58.081	143.150	A-1
Acetylene	C_2H_2	26.038	319.312	A-1
Air	-	28.966	287.037	A-1
Ammonia	NH_3	17.031	488.199	A-2
Argon	Ar	39.948	208.129	A-2
Arsine	AsH_3	77.946	106.668	A-2
Arsine, Trideuterated	AsD_3	80.964	102.692	A-2
Benzene	C_6H_6	78.115	106.437	A-3
Boron Fluoride Oxide, Trimeric	$(BOF)_3$	137.426	60.500	A-3
Boron Tribromide	BBr_3	250.538	33.186	A-3
Boron Trichloride	BCl_3	117.170	70.959	A-4
Boron Trifluoride	BF_3	67.806	122.619	A-4
Bromine	Br_2	159.818	52.024	A-4
Bromine (Monatomic)	Br	79.909	104.047	A-5
Bromine Chloride	BrCl	115.362	72.072	A-5
Bromine Fluoride	BrF	98.907	84.062	A-5
Bromine Pentafluoride	BrF_5	174.901	47.537	A-5
Bromoform	$CHBr_3$	252.746	32.896	A-5
Bromomethane	CH_3Br	94.944	87.571	A-6
Bromotrichloromethane	CCl_3Br	198.279	41.932	A-6
1,3-Butadiene	$(CH_2CH)_2$	54.092	153.706	A-6
iso-Butane	$i\text{-}C_4H_{10}$	58.124	143.044	A-6
n-Butane	$n\text{-}C_4H_{10}$	58.124	143.044	A-7
1-Butanol	$CH_3(CH_2)_3OH$	74.124	112.168	A-7
2-Butanone	$CH_3CH_2COCH_3$	72.108	115.304	A-7
1-Butene	$CH_2CHCH_2CH_3$	56.108	148.183	A-7
2-Butene	$(CH_3CH)_2$	56.108	148.183	A-8
cis-2-Butene	$(CH_3CH)_2$	56.108	148.183	A-8
trans-2-Butene	$(CH_3CH)_2$	56.108	148.183	A-8
Butyl Ether	$[CH_3(CH_2)_3]_2O$	130.232	63.842	A-8
1-Butyne	$CHCCH_2CH_3$	54.092	153.706	A-8
2-Butyne	$(CH_3C)_2$	54.092	153.706	A-9
Carbon (Atomic)	C	12.0112*	692.217	A-9
Carbon Dioxide	CO_2	44.010	188.919	A-9
Carbon Disulfide	CS_2	76.139	109.199	A-10
Carbon Monoxide	CO	28.011	296.828	A-10
Carbon Monosulfide	CS	44.075	188.640	A-10

*Atomic weight of carbon is 12.01115

TABLE A-I
(CONT.)

NAME	FORMULA	AT. WT/ MOL WT	GAS CONST	APP A PAGE
Carbon Suboxide	C_3O_2	68.032	122.211	A-10
Carbon Tetrabromide	CBr_4	331.647	25.070	A-10
Carbon Tetrachloride	CCl_4	153.823	54.051	A-11
Carbonyl Chloride Fluoride	COClF	82.462	100.826	A-11
Carbonyl Fluoride	COF_2	66.007	125.961	A-11
Carbonyl Sulfide	COS	60.075	138.400	A-11
Chlorine	Cl_2	70.906	117.258	A-12
Chlorine (Monatomic)	Cl	35.453	234.517	A-12
Chlorine Dioxide	ClO_2	67.452	123.263	A-12
Chlorine Fluoride	ClF	54.451	152.692	A-12
Chlorine Monoxide	Cl_2O	86.905	95.671	A-13
Chlorine Oxide	ClO	51.452	161.592	A-13
Chlorine Trifluoride	ClF_3	92.448	89.935	A-13
Chlorodifluoromethane (FREON-22)	$CHClF_2$	86.469	96.154	A-13
Chlorodifluoromethane, Monodeuterated	$CDClF_2$	87.475	95.048	A-14
Chloroform	$CHCl_3$	119.378	69.647	A-14
Chlorofluoromethane	CH_2ClF	68.478	121.415	A-14
Chloromethylidyne	CCl	47.464	175.171	A-15
Chlorosilane	SiH_3Cl	66.563	124.909	A-15
Chlorotrifluoro-methane (FREON-13)	$CClF_3$	104.459	79.594	A-15
Cumene	$C_6H_5CH(CH_3)_2$	120.196	69.173	A-15
Cyanogen	$(CN)_2$	52.036	159.781	A-15
Cyanogen Chloride	CNCl	61.471	135.256	A-16
Cyclohexane - See Hexane				
Cyclopropane - See Propane				
n-Decane	$C_{10}H_{22}$	142.287	58.434	A-16
n-Deuterium	D_2	4.028	2064.131	A-16
Deuterium (monatomic)	D	2.014	4128.262	A-17
Dibromomethane	CH_2Br_2	173.845	47.826	A-17
Dichlorodifluoro-methane (FREON-12)	CCl_2F_2	120.914	68.762	A-17
1,1-Dichloro-1-fluoroethane	CH_3CFCl_2	116.951	71.093	A-17
Dichlorofluoromethane (FREON-21)	$CHCl_2F$	102.924	80.782	A-17
Dichlorofluoromethane, Monodeuterated	$CDCl_2F$	103.930	80.000	A-18
Dichloromethane	CH_2Cl_2	84.933	97.893	A-18
1,1-Dichlorotetra-fluoroethane	CCl_2FCF_3	170.922	48.644	A-18

TABLE A-I
(CONT.)

NAME	FORMULA	AT. WT/ MOL WT	GAS CONST	APP A PAGE
Dichlorotetrafluoro-ethane (FREON-114)	$C_2Cl_2F_4$	170.922	48.644	A-18
2,2-Dichloro-1,1,1-trifluoroethane	F_3CCHCl_2	152.931	54.366	A-18
1,1-Difluoroethylene	CH_2CF_2	64.035	129.840	A-19
Difluoromethane	CH_2F_2	52.024	159.817	A-19
Dimethylamine	$(CH_3)_2NH$	45.085	184.415	A-19
2,2-Dimethylbutane	$CH_3CH_2C(CH_3)_3$	86.178	96.478	A-19
2,3-Dimethylbutane	$[(CH_3)_2CH]_2$	86.178	96.478	A-19
2,3-Dimethylhexane	$(CH_3)_2CHCH(CH_3)(CH_2)_2CH_3$	114.233	72.784	A-20
3,4-Dimethylhexane	$[CH(CH_3)CH_2CH_3]_2$	114.233	72.784	A-20
Dimethylpropane	$C(CH_3)_4$	72.151	115.234	A-20
Dipropylene Glycol	$(CH_3CHOHCH_2)_2O$	134.177	61.965	A-20
Dodecane	$CH_3(CH_2)_{10}CH_3$	170.341	48.810	A-20
Ethane	C_2H_6	30.070	276.498	A-21
Ethane, Hexadeuterated	C_2D_6	36.106	230.273	A-21
Ethanethiol	C_2H_5SH	62.134	133.812	A-21
Ethyl Acetate	$CH_3COOCH_2CH_3$	88.107	94.366	A-21
Ethyl Alcohol	C_2H_5OH	46.070	180.473	A-22
Ethylbenzene	$C_6H_5C_2H_5$	106.169	78.312	A-22
Ethyl Ether	$C_4H_{10}O$	74.124	112.168	A-22
Ethylene	C_2H_4	28.054	296.367	A-22
Ethylene Oxide	$(CH_2)_2O$	44.054	188.732	A-23
3-Ethylhexane	$(CH_3CH_2)_2CH(CH_2)_2CH_3$	114.233	72.784	A-23
3-Ethyl-2-methyl-pentane	$(CH_3)_2CHCH(C_2H_5)_2$	114.233	72.784	A-23
3-Ethyl-3-methyl-pentane	$(CH_3CH_2)_3CCH_3$	114.233	72.784	A-23
Fluorine	F_2	37.997	218.816	A-24
Fluorine (monatomic)	F	18.9984	437.633	A-24
Fluoroethane	CH_3CH_2F	48.061	172.997	A-24
Fluoroethylene	CH_2CHF	46.045	180.571	A-24
Fluoroform, Monodeut.	CF_3D	71.020	117.070	A-25
Fluoromethane	CH_3F	34.033	244.298	A-25
Formaldehyde	HCHO	30.026	276.899	A-25
Formyl	HCO	29.019	286.518	A-25
Furan	C_4H_4O	68.076	122.133	A-25
Helium	He	4.003	2077.022	A-26
n-Heptane	C_7H_{16}	100.206	82.973	A-26
Hexafluoroethane	$(CF_3)_2$	138.013	60.243	A-26
n-Hexane	C_6H_{14}	86.178	96.478	A-26

TABLE A-I
(CONT.)

NAME	FORMULA	AT. WT/ MOL WT	GAS CONST	APP A PAGE
Cyclohexane	C_6H_{12}	84.163	98.789	A-27
Hydrazine	N_2H_4	32.045	259.455	A-27
Hydrobromic Acid	HBr	80.917	102.751	A-27
Hydrocyanic Acid	HCN	27.026	307.644	A-27
Hydrofluoric Acid	HF	20.006	415.584	A-28
Hydrofluoric Acid, Monodeuterated	DF	21.012	395.686	A-28
Hydrogen	H_2	2.016	4124.289	A-28
Hydrogen (Monatomic)	H	1.008	8248.579	A-29
Hydrogen, Monodeut.	HD	3.022	2751.291	A-29
Hydrogen Chloride	HCl	36.461	228.033	A-29
Hydrogen Iodide	HI	127.912	65.000	A-29
Hydrogen Peroxide	H_2O_2	34.015	244.433	A-29
Hydrogen Sulfide	H_2S	34.080	243.965	A-30
Hydrogen Sulfide, Dideuterated	D_2S	36.092	230.365	A-30
Hydrogen Sulfide, Ditritiated	T_2S	38.098	218.235	A-30
Hydrogen Sulfide, Monodeuterated	HDS	35.086	236.970	A-30
Hydrogen Sulfide, Monodeut/monotrit.	DTS	37.095	224.136	A-30
Hydrogen Sulfide, Monotritiated	HTS	36.089	230.384	A-31
Hydroxyl	OH	17.007	488.866	A-31
Iodine	I_2	253.809	32.758	A-31
Iodine (monatomic)	I	126.9044	65.516	A-31
Iodine Bromide	IBr	206.813	40.202	A-31
Iodine Chloride	ICl	162.357	51.210	A-31
Iodine Fluoride	IF	145.903	56.985	A-32
Iodine Heptafluoride	IF_7	259.893	31.991	A-32
Iodine Pentafluoride	IF_5	221.896	37.469	A-32
Iodomethane	CH_3I	141.939	58.577	A-32
Isoprene	$CH_2C(CH_3)CHCH_2$	68.120	122.055	A-32
Ketene	H_2CCO	42.038	197.783	A-33
Krypton	Kr	83.80	99.216	A-33
Mesitylene	$C_6H_3(CH_3)_3$	120.196	69.173	A-33
Methane	CH_4	16.043	518.251	A-33
Methane, Dideuterated	CH_2D_2	18.055	460.497	A-34
Methane, Dideut, Ditrit.	CD_2T_2	22.073	376.671	A-34
Methane, Ditritiated	CH_2T_2	20.061	414.450	A-34
Methane, Monodeut.	CH_3D	17.049	487.670	A-34

TABLE A-I
(CONT.)

NAME	FORMULA	AT. WT/ MOL WT	GAS CONST	APP A PAGE
Methane, Monodeut., Tritritiated	CDT_3	23.076	360.299	A-34
Methane, Monotrit.	CH_3T	18.052	460.575	A-34
Methane, Tetradeut.	CD_4	20.067	414.325	A-35
Methane, Tetratrit.	CT_4	24.079	345.291	A-35
Methane, Trideut.	CHD_3	19.061	436.193	A-35
Methane, Trideut., Monotritiated	CD_3T	21.070	394.602	A-35
Methane, Tritriated	CHT_3	22.070	376.723	A-35
Methanethiol	CH_3SH	48.107	172.830	A-35
Methyl	CH_3	15.035	552.995	A-36
Methyl Acetate	CH_3COOCH_3	74.080	112.234	A-36
Methyl Alcohol	CH_3OH	32.042	259.478	A-36
Methylamine	CH_3NH_2	31.058	267.706	A-36
2-Methylbutane	$(CH_3)_2CHCH_2CH_3$	72.151	115.234	A-36
2-Methyl-2-butanol	$(CH_3)_2COHCH_2CH_3$	88.151	94.319	A-37
3-Methyl-1-butanol	$(CH_3)_2CH(CH_2)_2OH$	88.151	94.319	A-37
3-Methyl-1-butyne	$(CH_3)_2CHCCH$	68.120	122.055	A-37
Methyl Chloride	CH_3Cl	50.488	164.679	A-37
Methyl Cyanide	CH_3CN	41.053	202.527	A-38
Methyl Ether	$(CH_3)_2O$	46.070	180.473	A-38
Methylhydrazine	CH_3NHNH_2	46.072	180.462	A-38
Methylidyne	CH	13.019	638.624	A-38
Methyl Isocyanide	CH_3NC	41.053	202.527	A-38
2-Methylpentane	$(CH_3)_2CH(CH_2)_2CH_3$	86.178	96.478	A-39
3-Methylpentane	$[CH_3CH_2]_2CH(CH_3)$	86.178	96.478	A-39
4-Methyl-2-pentanone	$CH_3COCH_2CH(CH_3)_2$	100.162	83.009	A-39
2-Methyl-1-propanol	$(CH_3)_2CHCH_2OH$	74.124	112.168	A-39
2-Methyl-2-propanol	$(CH_3)_3COH$	74.124	112.168	A-40
2-Methylpropene	$(CH_3)_2CCH_2$	56.108	148.183	A-40
Methyl Sulfide	$(CH_3)_2S$	62.134	133.812	A-40
Neon	Ne	20.183	411.947	A-40
Nitric Oxide	NO	30.006	277.088	A-40
Nitrogen	N_2	28.013	296.798	A-41
Nitrogen (Monatomic)	N	14.0067	593.596	A-41
Nitrous Oxide	N_2O	44.013	188.907	A-41
n-Nonane	C_9H_{20}	128.260	64.824	A-42
n-Octane	C_8H_{18}	114.233	72.784	A-42

TABLE A-I
(CONT.)

NAME	FORMULA	AT.WT/ MOL WT	GAS CONST	APP A PAGE
Oxygen	O_2	31.999	259.832	A-42
Oxygen (Monatomic)	O	15.9994	519.664	A-43
Oxygen Fluoride	OF_2	53.996	153.980	A-43
n-Pentane	C_5H_{12}	72.151	115.234	A-44
1-Pentanol	$CH_3(CH_2)_4OH$	88.151	94.319	A-44
3-Pentanone	$(C_2H_5)_2CO$	86.135	96.527	A-44
1-Pentene	$CH_2CH(CH_2)_2CH_3$	70.135	118.547	A-45
1-Pentyne	$HCCCH_2CH_2CH_3$	68.120	122.055	A-45
2-Pentyne	$CH_3CCCH_2CH_3$	68.120	122.055	A-45
Phosgene	$COCl_2$	98.917	84.054	A-45
Phosphine	PH_3	33.998	244.555	A-46
Phosphine, Trideut.	PD_3	37.016	224.615	A-46
Phosphorus Trichloride	PCl_3	137.333	60.541	A-46
Phosphorus Trifluoride	PF_3	87.969	94.514	A-46
Propadiene	$C(CH_2)_2$	40.065	207.519	A-46
Propane	C_3H_8	44.097	188.545	A-47
Cyclopropane	C_3H_8	44.097	188.545	A-47
1,2-Propanediol	$CH_3CHOHCH_2OH$	76.096	109.261	A-47
1-Propanol	$CH_3(CH_2)_2OH$	60.097	138.349	A-47
2-Propanol	$(CH_3)_2CHOH$	60.097	138.349	A-48
Propylbenzene	$C_6H_5(CH_2)_2CH_3$	120.196	69.173	A-48
Propyl Ether	$[CH_3(CH_2)_2]_2O$	102.178	81.371	A-48
Propyne	CH_3CCH	40.065	207.519	A-48
Silane	SiH_4	32.118	258.869	A-49
Silicon Tetrachloride	$SiCl4$	169.898	48.937	A-49
Silicon Tetrafluoride	SiF_4	104.080	79.884	A-49
Styrene	$C_6H_5CHCH_2$	104.153	79.828	A-49
Sulfur	S_2	64.128	129.652	A-49
Sulfur (monatomic)	S	32.064	259.304	A-49
Sulfur Dichloride	SCl_2	102.970	80.745	A-50
Sulfur Difluoride	SF_2	70.061	118.673	A-50
Sulfur Dioxide	SO_2	64.063	129.784	A-50
Sulfur Hexafluoride	SF_6	146.054	56.926	A-50
Sulfur Monochloride	S_2Cl_2	135.034	61.572	A-50
Sulfur Monoxide	SO	48.063	172.987	A-50
Sulfur Tetrafluoride	SF_4	108.058	76.943	A-51
Sulfur Trioxide	SO_3	80.062	103.848	A-51
Sulfuryl Fluoride	SO_2F_2	102.060	81.465	A-51
Thionyl Chloride	$SOCl_2$	118.969	69.886	A-51
Thionyl Fluoride	SOF_2	86.060	96.611	A-51
Thiophosgene	$CSCl_2$	114.981	72.310	A-51
Toluene	C_7H_8	92.142	90.234	A-52
1,1,1-Trichloroethane	CH_3CCl_3	133.405	62.324	A-52

TABLE A-I
(CONT.)

NAME	FORMULA	AT WT/ MOL WT	GAS CONST	APP A PAGE
Trichlorofluoro-methane (FREON-11)	CCl_3F	137.369	60.526	A-52
Trichlorotrifluoro-ethane (FREON-113)	$C_2Cl_3F_3$	187.377	44.372	A-53
Trichlorosilane	$SiHCl_3$	135.453	61.382	A-53
1,1,1-trichloro-2,2,2-trifluoroethane	CF_3CCl_3	187.377	44.372	A-53
1,1,1-Trifluoroethane	CH_3CF_3	84.041	98.931	A-53
Trifluoroiodomethane	CF_3I	195.911	42.439	A-54
Trimethylamine	$(CH_3)_3N$	59.112	140.654	A-54
2,3,4-Trimethyl-pentane	$[(CH_3)_2CH]_2CHCH_3$	114.233	72.784	A-54
Water	H_2O	18.015	461.513	A-54
Water, Dideuterated	D_2O	20.027	415.147	A-55
Xenon	Xe	131.30	63.323	A-55
m-Xylene	$C_6H_4(CH_3)_2$	106.169	78.312	A-55
o-Xylene	$C_6H_4(CH_3)_2$	106.169	78.312	A-56
p-Xylene	$C_6H_4(CH_3)_2$	106.169	78.312	A-56

APPENDIX A
FORMAT EXAMPLE

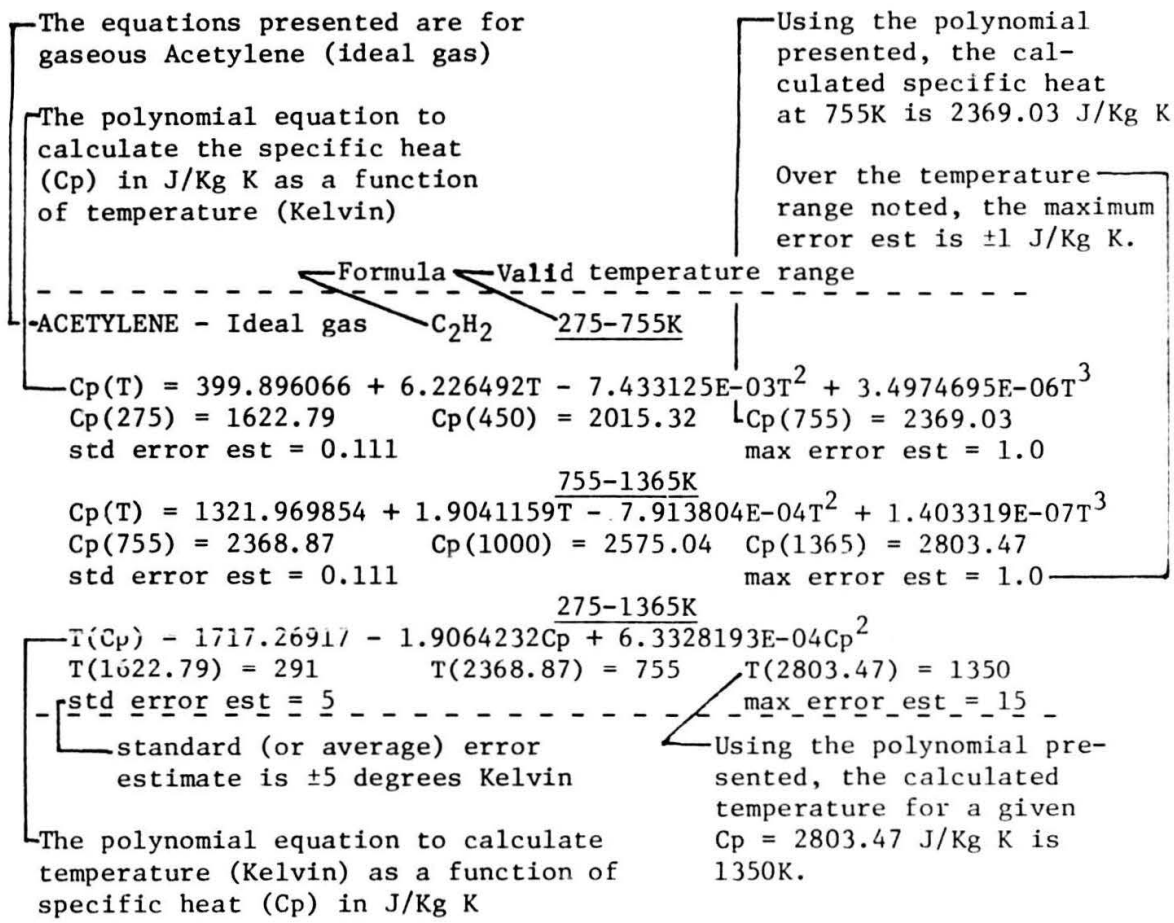

FIGURE A-1

APPENDIX A

SPECIFIC HEAT AT CONSTANT PRESSURE FOR GASEOUS ELEMENTS AND COMPOUNDS

ACETONE - Ideal gas C_3H_6O 275-1365K

$Cp(T) = 345.6240845 + 3.1344046T + 9.000608E\text{-}04T^2 - 1.9981015E\text{-}06T^3 - 7.2481823E\text{-}10T^4 + 1.757756E\text{-}12T^5 - 5.94192596E\text{-}16T^6$

Cp(275) = 1232.46 Cp(700) = 2346.88 Cp(1365) = 3189.13
std error est = 0.791 max error est = 1.25

275-1365K

$T(Cp) = -537.70187 + 1.08064298Cp - 4.673706E\text{-}04Cp^2 + 9.857246E\text{-}08Cp^3$

T(1232.46) = 269 T(2346.88) = 698 T(3189.13) = 1352
std error est = 3 max error est = 13

ACETYLENE - Ideal gas C_2H_2 275-755K

$Cp(T) = 399.896066 + 6.226492T - 7.433125E\text{-}03T^2 + 3.4974695E\text{-}06T^3$

Cp(275) = 1622.79 Cp(450) = 2015.32 Cp(755) = 2369.03
std error est = 0.111 max error est = 1.0

755-1365K

$Cp(T) = 1321.969854 + 1.9041159T - 7.913804E\text{-}04T^2 + 1.403319E\text{-}07T^3$

Cp(755) = 2368.87 Cp(1000) = 2575.04 Cp(1365) = 2803.47
std error est = 0.111 max error est = 1.0

275-1365K

$T(Cp) = 1717.26917 - 1.9064232Cp + 6.3328193E\text{-}04Cp^2$

T(1622.79) = 291 T(2368.87) = 755 T(2803.47) = 1350
std error est = 5 max error est = 15

AIR - Ideal gas 100-590K

$Cp(T) = 1022.5294853 - 0.1758625T + 4.020605E\text{-}04T^2 - 4.8640623E\text{-}08T^3$

Cp(100) = 1008.92 Cp(350) = 1008.14 Cp(590) = 1048.74
std error est = 0.012 max error est = 0.025

590-1365K

$Cp(T) = 928.911894 + 0.0897769T + 3.2460657E\text{-}04T^2 - 2.62542E\text{-}07T^3 + 5.99901E\text{-}11T^4$

Cp(590) = 1048.22 Cp(1000) = 1140.74 Cp(1365) = 1196.81
std error est = 0.22 max error est = 0.5

590-1365K

$T(Cp) = -100444.9907 + 275.16644Cp - 0.253212Cp^2 + 7.885293E\text{-}05Cp^3$

T(1048.22) = 588 T(1140.74) = 998 T(1196.81) = 1361
std error est = 1.5 max error est = 4

Note: For T(Cp) calculations below 590K use the iterative procedures discussed in Section 5 and the following polynomial: 100-590K, $Cp(T) = 1021.17215 - 0.1603904T + 3.5182525E\text{-}04T^2$.

AIR - Real gas 255-865K

$Cp(T) = 1052.71406 - 0.3745355T + 8.361477E\text{-}04T^2 - 3.32111E\text{-}07T^3 - 4.683905E\text{-}11T^4$

Cp(255) = 1005.87 Cp(560) = 1042.26 Cp(865) = 1113.2

std error est = 0.17 max error est = 0.4

Note: For T(Cp) calculations use the iterative procedures discussed in Section 5 and the following polynomial: 255-865K, $Cp(T) = 996.831581 - 0.0322256T + 2.0181265E\text{-}04T^2$.

AMMONIA - Ideal gas NH_3 220-590K

$Cp(T) = 1948.475605 - 0.81912827T + 5.424779E\text{-}03T^2 - 3.60715E\text{-}06T^3$

Cp(220) = 1992.42 Cp(400) = 2257.93 Cp(590) = 2612.72

std error est = 0.12 max error est = 1.0

590-1365K

$Cp(T) = 2124.419956 - 1.746889T + 8.22758E\text{-}03T^2 - 8.855634E\text{-}06T^3 + 4.420294E\text{-}09T^4 - 8.734964E\text{-}13T^5$

Cp(590) = 2612.19 Cp(1000) = 3296.27 Cp(1365) = 3753.45

std error est = 0.36 max error est = 1.0

220-590K

$T(Cp) = -8836.6068 + 10.54741Cp - 4.154804E\text{-}03Cp^2 + 5.737145E\text{-}07Cp^3$

T(1992.42) = 222 T(2257.93) = 401 T(2612.72) = 591

std error est = 0.8 max error est = 2.0

590-1365K

$T(Cp) = -2501.9985 + 2.45231Cp - 7.299265E\text{-}04Cp^2 + 9.350415E\text{-}08Cp^3$

T(2612.19) = 590 T(3296.27) = 999 T(3753.45) = 1364

std error est = 0.5 max error est = 2.0

ARGON - Ideal gas Ar 0-6000K

Cp = 520.34 (constant)

ARSINE AsH_3 300-1000K

$Cp(T) = 347.13902 + 0.231073T + 1.309066E\text{-}03T^2 - 1.577571E\text{-}06T^3 + 5.450638E\text{-}10T^4$

Cp(300) = 496.1 Cp(600) = 686.93 Cp(1000) = 854.77

std error est = 1.13 max error est = 2.0

300-1000K

$T(Cp) = -1935.0966 + 9.24965Cp - 1.33801E\text{-}02Cp^2 + 7.69057E\text{-}06Cp^3$

T(496.1) = 300 T(686.93) = 598 T(854.77) = 998

std error est = 3.3 max error est = 5.0

ARSINE, Trideuterated AsD_3 300-1000K

$Cp(T) = 245.545853 + 1.09726T - 3.84163E\text{-}05T^2 - 8.056253E\text{-}07T^3 + 4.042793E\text{-}10T^4$

Cp(300) = 552.79 Cp(600) = 768.45 Cp(1000) = 903.04

ARSINE, Trideuterated (continued)

std error est = 0.43 max error est = 2.0

300-1000K

$T(Cp) = 8581.361485 - 52.568517Cp + 0.121435Cp^2 - 1.22502E\text{-}04Cp^3 + 4.6727183E\text{-}08Cp^4$

T(552.79) = 300 T(768.45) = 599 T(903.04) = 1000

std error est = 1.3 max error est = 3.0

BENZENE - Ideal gas C_6H_6 275-1365K

$Cp(T) = -297.4345373 + 4.42278708T + 2.810036E\text{-}03T^2 - 1.136955E\text{-}05T^3 + 1.1190287E\text{-}08T^4 - 4.8717996E\text{-}12T^5 + 8.019155E\text{-}16T^6$

Cp(275) = 951.57 Cp(800) = 2415.38 Cp(1365) = 3008.37

std error est = 0.67 max error est = 1.3

275-1365K

$T(Cp) = 392.0602 - 0.648326Cp + 8.326166E\text{-}04Cp^2 - 3.4749E\text{-}07Cp^3 + 5.9114275E\text{-}11Cp^4$

T(951.57) = 278 T(2415.38) = 799 T(3008.37) = 1358

std error est = 1.6 max error est = 7

BENZENE - Real gas 300-600K

$Cp(T) = -283.22595 + 5.300935T - 2.4209348E\text{-}03T^2$

Cp(300) = 1089.17 Cp(450) = 1611.96 Cp(600) = 2025.8

std error est = 0.9 max error est = 1.5

300-600K

$T(Cp) = 129.444998 + 0.07207415Cp + 7.8699477E\text{-}05Cp^2$

T(1089.17) = 301 T(1611.96) = 450 T(2025.8) = 598

BORON FLUORIDE OXIDE, $(BOF)_3$ 300-500K

Trimeric

$Cp(T) = 79.2504 + 3.2856459T - 2.3282776E\text{-}03T^2$

Cp(300) = 855.4 Cp(400) = 1021 Cp(500) = 1140

std error est = 0.6 max error est = 1.0

300-500K

$T(Cp) = 505.381375 - 0.9481142Cp + 8.275349E\text{-}04Cp^2$

T(855.4) = 300 T(1021) = 400 T(1140) = 500

std error est = 0.4 max error est = 1.0

BORON TRIBROMIDE BBr_3 300-1000K

$Cp(T) = 140.1554722 + 0.71322266T - 1.1636584E\text{-}03T^2 + 9.112207E\text{-}07T^3 - 2.780408E\text{-}10T^4$

Cp(300) = 271.74 Cp(650) = 312.72 Cp(1000) = 322.9

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations use the iterative procedures discussed in Section 5 and: $Cp(T) = 212.708133 + 0.24356T - 1.35451E\text{-}04T^2$.

BORON TRICHLORIDE BCl_3 100-1500K

$Cp(T) = 188.655802 + 1.888567T - 3.184433E\text{-}03T^2 + 2.8712E\text{-}06T^3 - 1.3291673E\text{-}09T^4 + 2.474797E\text{-}13T^5$

Cp(100) = 348.8 Cp(800) = 668.19 Cp(1500) = 697.22

std error est = 0.5 max error est = 1.0

BORON TRIFLUORIDE BF_3 145-645K

Ideal gas

$Cp(T) = 298.65561 + 1.865263T - 1.3085604E\text{-}03T^2 + 1.995E\text{-}07T^3$

Cp(145) = 542.21 Cp(400) = 848.16 Cp(645) = 1010.89

std error est = 0.24 max error est = 1.0

645-1365K

$Cp(T) = 466.430362 + 1.331415T - 8.914198E\text{-}04T^2 + 2.12377E\text{-}07T^3$

Cp(645) = 1011.33 Cp(1000) = 1118.80 Cp(1365) = 1163.04

std error est = 0.11 max error est = 1.0

145-645K

$T(Cp) = 1438.87308 - 8.75606Cp + 0.020047Cp^2 - 1.908134E\text{-}05Cp^3 + 6.971855E\text{-}09Cp^4$

T(542.21) = 146 T(848.16) = 399 T(1010.89) = 642

std error est = 0.6 max error est = 3.0

645-1365K

$T(Cp) = -180147.73 + 519.93406Cp - 0.5005Cp^2 + 1.613357E\text{-}04Cp^3$

T(1011.33) = 653 T(1118.80) = 1009 T(1163.04) = 1362

std error est = 5.2 max error est = 12

BROMINE - Ideal gas Br_2 200-590K

$Cp(T) = 175.261725 + 0.304817T - 5.66955E\text{-}04T^2 + 3.5797E\text{-}07T^3 + 1.30779E\text{-}11T^4$

Cp(200) = 216.43 Cp(400) = 229.72 Cp(590) = 232.85

std error est = 1.2E-02 max error est = 0.2

590-1365K

$Cp(T) = 223.7002 + 2.231436E\text{-}02T - 1.335276E\text{-}05T^2 + 3.0736E\text{-}09T^3$

Cp(590) = 232.85 Cp(1000) = 235.74 Cp(1365) = 237.097

std error est = 9.9E-03 max error est = 0.2

200-590K

$T(Cp) = -649483.9088 + 2282.92562Cp + 48.1995412Cp^2 - 0.335799Cp^3 + 5.93457E\text{-}04Cp^4$

T(216.43) = 183 T(229.72) = 402 T(232.85) = 589

std error est = 6.0 max error est = 17.0

590-1365K

$T(Cp) = 1327415.6666 - 11467.00468Cp + 24.77498Cp^2$

T(232.85) = 601 T(235.74) = 1013 T(237.097) = 1348

std error est = 7.0 max error est = 21

BROMINE (Monatomic) B 250-1500K

$Cp(T) = 264.48344899 - 2.672822E\text{-}02T + 4.013018E\text{-}05T^2 - 1.04915E\text{-}08T^3$

Cp(250) = 260.14 Cp(900) = 265.29 Cp(1500) = 279.28

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 260.01432 - 5.58942E\text{-}03T + 1.263795E\text{-}05T^2$.

BROMINE CHLORIDE BrCl 250-1500K

$Cp(T) = 194.97556 + 0.764857T - 2.058934E\text{-}03T^2 + 3.0416852E\text{-}06T^3 - 2.5048785E\text{-}09T^4 + 1.07526E\text{-}12T^5 - 1.870628E\text{-}16T^6$

Cp(250) = 296.25 Cp(900) = 325.06 Cp(1500) = 328.89

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 283.400876 + 7.585277E\text{-}02T - 3.15832E\text{-}05T^2$.

BROMINE FLUORIDE BrF 250-1500K

$Cp(T) = 241.432653 + 0.456866T - 6.069283E\text{-}04T^2 + 3.694047E\text{-}07T^3 - 8.374216E\text{-}11T^4$

Cp(250) = 323.16 Cp(900) = 375.35 Cp(1500) = 383.94

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 266.492708 + 0.291667T - 2.572893E\text{-}04T^2 + 7.705475E\text{-}08T^3$.

BROMINE PENTAFLUORIDE BrF_5 250-1500K

$Cp(T) = -106.97977 + 4.406352T - 1.040336E\text{-}02T^2 + 1.362716E\text{-}05T^3 - 1.013227E\text{-}08T^4 + 3.9961242E\text{-}12T^5 - 6.484931E\text{-}16T^6$

Cp(250) = 521.49 Cp(900) = 733.47 Cp(1500) = 750.86

std error est = 0.51 max error est = 1.0

BROMOFORM $CHBr_3$ 100-1500K

$Cp(T) = 142.57457 + 0.651772857T - 5.93501E\text{-}04T^2 + 1.831537E\text{-}07T^3$

Cp(100) = 202.0 Cp(900) = 381.95 Cp(1500) = 403.0

std error est = 0.01 max error est = 0.1

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the equation above.

BROMOMETHANE CH_3Br 300-1200K

$Cp(T) = 145.940214 + 1.19246T - 6.440412E\text{-}04T^2 + 1.4439654E\text{-}07T^3$

Cp(300) = 449.61 Cp(800) = 761.65 Cp(1200) = 898.99

std error est = 1.33 max error est = 3.0

300-1200K

$T(Cp) = -799.119 + 4.44998Cp - 6.457116E\text{-}03Cp^2 + 4.4251195E\text{-}06Cp^3$

T(449.61) = 298 T(761.65) = 800 T(898.99) = 1198

std error est = 2.6 max error est = 5.0

BROMOTRICHLORO-METHANE CCl_3Br 100-1500K

$Cp(T) = 113.19427 + 1.6936076T - 2.71334E\text{-}03T^2 + 1.949586E\text{-}06T^3 - 5.11705E\text{-}10T^4$

Cp(100) = 257.32 Cp(900) = 525.15 Cp(1500) = 537.94

std error est = 3.2 max error est = 6.0

1,3-BUTADIENE $(CH_2CH)_2$ 275-1500K

$Cp(T) = -254.813554 + 7.020756T - 3.20957E\text{-}03T^2 - 5.334136E\text{-}06T^3 + 8.92008E\text{-}09T^4 - 5.015366E\text{-}12T^5 + 1.006158E\text{-}15T^6$

Cp(275) = 1365.8 Cp(900) = 3001.2 Cp(1500) = 3585.32

std error est = 1.33 max error est = 6.0

275-1500K

$T(Cp) = 857.73873 - 1.465754Cp + 1.1834E\text{-}03Cp^2 - 3.7378E\text{-}07Cp^3 + 4.785293E\text{-}11Cp^4$

T(1365.8) = 278 T(3001.2) = 896 T(3585.32) = 1495

std error est = 3.5 max error est = 5.0

iso-BUTANE $i\text{-}C_4H_{10}$ 275-1365K

Ideal gas

$Cp(T) = -78.01978396 + 6.892987T - 4.385152E\text{-}03T^2 + 4.553157E\text{-}06T^3 - 6.538463E\text{-}09T^4 + 4.658174E\text{-}12T^5 - 1.18572476E\text{-}15T^6$

Cp(275) = 1550.03 Cp(900) = 3723.52 Cp(1365) = 4445.63

std error est = 1.05 max error est = 2.1

275-1365K

$T(Cp) = 232.4366 - 0.244747Cp + 2.728018E\text{-}04Cp^2 - 7.6475562E\text{-}08Cp^3 + 9.0742275E\text{-}12Cp^4$

T(1550.03) = 276 T(3723.52) = 900 T(4445.63) = 1361

std error est = 1.0 max error est = 4.0

iso-BUTANE - Real gas 275-710K

$Cp(T) = 1700.20484 - 16.818853T + 0.1295973T^2 - 3.956676E\text{-}04T^3 + 6.527002E\text{-}07T^4 - 5.60803E\text{-}10T^5 + 1.96009E\text{-}13T^6$

Cp(275) = 1582.82 Cp(500) = 2562.96 T(710) = 3264.21

std error est = 1.2 max error est = 1.8

275-710K

$T(Cp) = 82.72775 + 0.05989134Cp + 4.0183998E\text{-}05Cp^2$

T(1582.82) = 278 T(2562.96) = 500 T(3264.21) = 706

iso-BUTANE - Real gas (continued)

std error est = 1.7 max error est = 6

n-BUTANE $n\text{-}C_4H_{10}$ 265-755K

Ideal gas

$Cp(T) = 236.65134 + 5.10573T - 4.16089E\text{-}04T^2 - 1.1450804E\text{-}06T^3$

Cp(265) = 1539.14 Cp(500) = 2542.36 Cp(755) = 3361.49

std error est = 0.2 max error est = 1.0

755-1365K

$Cp(T) = 4401.26486 - 13.90866545T + 3.471109E\text{-}02T^2 - 3.45278E\text{-}05T^3 + 1.619382E\text{-}08T^4 - 2.966666E\text{-}12T^5$

Cp(755) = 3360.77 Cp(1000) = 3903.04 Cp(1365) = 4436.19

std error est = 0.7 max error est = 1.5

265-1365K

$T(Cp) = -372.95792 + 0.63692878Cp - 1.95552E\text{-}04Cp^2 + 3.149068E\text{-}08Cp^3$

T(3360.77) = 754 T(3903.04) = 1006 T(4436.19) = 1353

std error est = 3.5 max error est = 12

1-BUTANOL $CH_3(CH_2)_3OH$ 395-605K

$Cp(T) = 740069.2476 - 7408.748863T + 29.59687066T^2 - 5.88465E\text{-}02T^3 + 5.82563958E\text{-}05T^4 - 2.297227E\text{-}08T^5$

Cp(395) = 2048.05 Cp(500) = 2241.28 Cp(605) = 2555.35

std error est = 16.0 max error est = 23.0

Note: This is an extremely poor fit of the tabular data. The max error est of 23 represents an error of 1.2% of the table data.

2-BUTANONE $CH_3CH_2COCH_3$ 275-1275K

$Cp(T) = 20.545066 + 7.021058T - 1.15892E\text{-}02T^2 + 1.631369E\text{-}05T^3 - 1.31136E\text{-}08T^4 + 4.917275E\text{-}12T^5 - 5.9919712E\text{-}16T^6$

Cp(275) = 1346.65 Cp(800) = 2655.8 Cp(1275) = 3284.96

std error est = 6.6 max error est = 12 (0.9%)

1-BUTENE $CH_2CHCH_2CH_3$ 275-1500K

$Cp(T) = 139.59317 + 4.97386775T + 1.700397E\text{-}03T^2 - 9.414594E\text{-}06T^3 + 1.0035756E\text{-}08T^4 - 4.7956263E\text{-}12T^5 + 8.828364E\text{-}16T^6$

Cp(275) = 1490.44 Cp(900) = 3352.02 Cp(1500) = 4097.32

std error est = 1.12 max error est = 2.5

275-1500K

$T(Cp) = 739.649 - 1.1519803Cp + 8.633103E\text{-}04Cp^2 - 2.397716E\text{-}07Cp^3 + 2.6524417E\text{-}11Cp^4$

T(1490.44) = 277 T(3352.02) = 896 T(4097.32) = 1496

std error est = 3.2 max error est = 6.0

2-BUTENE $(CH_3CH)_2$ 300-1000K

$Cp(T) = -53.440476 + 5.5916666T - 2.05714285E\text{-}03T^2$
$Cp(300) = 1438.92$ $Cp(600) = 2560.99$ $Cp(1000) = 3481.08$
std error est = 0.23 max error est = 1.0

300-1000K

$T(Cp) = 470.8465 - 0.72122159Cp + 6.591403E\text{-}04Cp^2 - 2.020906E\text{-}07Cp^3 + 2.435593E\text{-}11Cp^4$
$T(1438.92) = 300$ $T(2560.99) = 600$ $T(3481.08) = 999$
std error est = 1.4 max error est = 3

cis-2-BUTENE $(CH_3CH)_2$ 275-1500K

$Cp(T) = 593.119884 - 0.25533449T + 1.75336E\text{-}02T^2 - 3.26788E\text{-}05T^3 + 2.844997E\text{-}08T^4 - 1.2341584E\text{-}11T^5 + 2.139958E\text{-}15T^6$
$Cp(275) = 1313.49$ $Cp(900) = 3258.39$ $Cp(1500) = 4054.29$
std error est = 1.3 max error est = 3.0

275-1500K

$T(Cp) = 367.106 - 0.531809Cp + 5.3353694E\text{-}04Cp^2 - 1.6407E\text{-}07Cp^3 + 2.0168237E\text{-}11Cp^4$
$T(1313.49) = 277$ $T(3258.39) = 896$ $T(4054.29) = 1496$
std error est = 3.5 max error est = 5.0

trans-2-BUTENE $(CH_3CH)_2$ 275-1500K

$Cp(T) = 725.45579 + 0.662269T + 1.2774909E\text{-}02T^2 - 2.40152E\text{-}05T^3 + 2.06644E\text{-}08T^4 - 8.859714E\text{-}12T^5 + 1.5207345E\text{-}15T^6$
$Cp(275) = 1479.15$ $Cp(900) = 3296.61$ $Cp(1500) = 4068.29$
std error est = 1.2 max error est = 3.5

275-1500K

$T(Cp) = 525.129 - 0.865304Cp + 7.3369042E\text{-}04Cp^2 - 2.134057E\text{-}07Cp^3 + 2.4521456E\text{-}11Cp^4$
$T(1479.15) = 277$ $T(3296.61) = 897$ $T(4068.29) = 1496$
std error est = 3 max error est = 5.

BUTYL ETHER $[CH_3(CH_2)_3]_2O$ 275-1275K

$Cp(T) = 2220.96497 - 15.85878T + 8.3621339E\text{-}02T^2 - 1.752393E\text{-}04T^3 + 1.899729E\text{-}07T^4 - 1.0442973E\text{-}10T^5 + 2.2914465E\text{-}14T^6$
$Cp(275) = 1471.38$ $Cp(800) = 2929.33$ $Cp(1275) = 3333.16$
std error est = 9.0 max error est = 15.0

1-BUTYNE $CHCCH_2CH_3$ 300-1500K

$Cp(T) = 138.2438 + 5.66515T - 4.1092457E\text{-}03T^2 + 1.692264E\text{-}06T^3 - 3.051742E\text{-}10T^4$
$Cp(300) = 1511.18$ $Cp(800) = 2781.89$ $Cp(1500) = 3556.61$
std error est = 0.95 max error est = 2.0

1-BUTYNE (continued) 300-1500K

$T(Cp) = 1283.405 - 2.300184Cp + 1.743335E\text{-}03Cp^2 - 5.255778E\text{-}07Cp^3 + 6.240944E\text{-}11Cp^4$

T(1511.18) = 300 T(2781.89) = 799 T(3556.61) = 1496

std error est = 2.9 max error est = 5.0

2-BUTYNE $(CH_3C)_2$ 275-1500K

$Cp(T) = 724.78375 + 0.9002168T + 8.83253E\text{-}03T^2 - 1.6193317E\text{-}05T^3 + 1.3383997E\text{-}08T^4 - 5.528233E\text{-}12T^5 + 9.190746E\text{-}16T^6$

Cp(275) = 1371.78 Cp(800) = 2718.32 Cp(1500) = 3541.16

std error est = 2.3 max error est = 3.5

275-1500K

$T(Cp) = 654.8792 - 1.297667Cp + 1.18347475E\text{-}03Cp^2 - 3.8756E\text{-}07Cp^3 + 4.963734E\text{-}11Cp^4$

T(1371.78) = 277 T(2718.32) = 798 T(3541.16) = 1496

std error est = 3 max error est = 5

CARBON (Atomic) C 300-1445K

$Cp(T) = 1750.3859 - 8.858597E\text{-}02T + 1.578577E\text{-}04T^2 - 1.2551E\text{-}07T^3 + 3.676506E\text{-}11T^4$

Cp(300) = 1734.93 Cp(800) = 1731.34 Cp(1445) = 1733.59

std error est = 0.52 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 300-1445K, $Cp(T) = 1739.3435 - 0.018443T + 9.82288E\text{-}06T^2$.

CARBON DIOXIDE CO_2 200-1365K

Ideal gas

$Cp(T) = 453.86462 + 1.5334795T - 4.195556E\text{-}04T^2 - 1.871946E\text{-}06T^3 + 2.862388E\text{-}09T^4 - 1.6962E\text{-}12T^5 + 3.717285E\text{-}16T^6$

Cp(200) = 732.86 Cp(800) = 1167.77 Cp(1365) = 1308.13

std error est = 0.15 max error est = 1.0

200-1365K

$T(Cp) = 10042.464 - 44.323467Cp + 7.31304E\text{-}02Cp^2 - 5.29105E\text{-}05Cp^3 + 1.454422E\text{-}08Cp^4$

T(732.86) = 206 T(1167.77) = 798 T(1308.13) = 1352

std error est = 4 max error est = 14

CARBON DIOXIDE - Real gas 200-1365K

$Cp(T) = 678.012 - 0.390396T + 6.23594E\text{-}03T^2 - 1.3596256E\text{-}05T^3 + 1.3942973E\text{-}08T^4 - 7.036E\text{-}12T^5 + 1.40115E\text{-}15T^6$

Cp(200) = 760.75 Cp(800) = 1168.2 Cp(1365) = 1310.6

std error est = 0.7 max error est = 1.25

200-1365K

$T(Cp) = 7863.127 - 35.9779Cp + 6.10617E\text{-}02Cp^2 - 4.51148E\text{-}05Cp^3 + 1.26481E\text{-}08Cp^4$

CARBON DIOXIDE - Real gas (continued)

T(760.75) = 205 T(1168.2) = 796 T(1310.6) = 1350

std error est = 4.5 max error est = 17

CARBON DISULFIDE CS_2 100-1500K

$Cp(T) = 234.3967 + 2.083974T - 4.080167E\text{-}03T^2 + 4.899365E\text{-}06T^3 - 3.4779E\text{-}09T^4 + 1.329115E\text{-}12T^5 - 2.100283E\text{-}16T^6$

Cp(100) = 406.56 Cp(800) = 754.66 Cp(1500) = 809.08

std error est = 0.9 max error est = 2.0

CARBON MONOXIDE CO 255-1365K

Ideal gas

$Cp(T) = 1020.802 + 0.382075T - 2.4945E\text{-}03T^2 + 6.81145E\text{-}06T^3 - 7.93722E\text{-}09T^4 + 4.291972E\text{-}12T^5 - 8.903274E\text{-}16T^6$

Cp(255) = 1039.79 Cp(700) = 1113.16 Cp(1365) = 1242.76

std error est = 0.27 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 255-1365K, $Cp(T) = 1060.3 - 0.2338408T + 6.188684E\text{-}04T^2 - 2.584758E\text{-}07T^3$.

CARBON MONOXIDE - Real gas 275-1365K

$Cp(T) = 1036.64564 + 0.2738793T - 2.16729E\text{-}03T^2 + 6.279075E\text{-}06T^3 - 7.459832E\text{-}09T^4 + 4.072163E\text{-}12T^5 - 8.50011E\text{-}16T^6$

Cp(275) = 1042.02 Cp(700) = 1113.41 Cp(1365) = 1243.06

std error est = 0.26 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the 3rd degree polynomial in the note above.

CARBON MONOSULFIDE CS 100-1500K

$Cp(T) = 695.6713 - 0.590035T + 2.78573E\text{-}03T^2 - 4.25312E\text{-}06T^3 + 3.1619707E\text{-}09T^4 - 1.16023E\text{-}12T^5 + 1.6791E\text{-}16T^6$

Cp(100) = 660.58 Cp(800) = 787.89 Cp(1500) = 833.81

std error est = 1.1 max error est = 2.0

CARBON SUBOXIDE C_3O_2 275-1500K

$\ln[Cp(T)] = 5.7661716 + 6.399978E\text{-}03T - 1.20235687E\text{-}05T^2 + 1.16497649E\text{-}08T^3 - 5.5686458E\text{-}12T^4 + 1.03973134E\text{-}15T^5$

Cp(275) = 924.22 Cp(850) = 1377.47 Cp(1500) = 1533.42

Note: Cp(T) = exp[fctn(T) above] max error est = 36

CARBON TETRABROMIDE CBr_4 300-1000K

$Cp(T) = 195.977 + 0.3730265T - 3.99407E\text{-}04T^2 + 1.498015E\text{-}07T^3$

Cp300) = 275.98 Cp(600) = 308.36 Cp(1000) = 319.4

CARBON TETRABROMIDE (Continued)

std error est = 1.86 max error est = 3.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 300-1000K, $Cp(T) = 228.26176 + 0.1975507T - 1.0812615E\text{-}04T^2$.

CARBON TETRACHLORIDE CCl_4 100-700K

Ideal gas

$Cp(T) = 104.89579 + 2.318459T - 2.59822E\text{-}03T^2 - 2.90876E\text{-}06T^3 + 8.5781275E\text{-}09T^4 - 5.07917E\text{-}12T^5$

Cp(100) = 308.66 Cp(450) = 615.03 Cp(700) = 662.94

std error est = 0.4 max error est = 1.0

700-1365K

$Cp(T) = 458.4405 + 0.526876T - 4.11842E\text{-}04T^2 + 1.1014289E\text{-}07T^3$

Cp(700) = 663.23 Cp(1000) = 683.62 Cp(1365) = 690.4

std error est = 0.2 max error est = 1.0

100-700K

$T(Cp) = 4845.83 - 45.40359Cp + 0.158658Cp^2 - 2.40639E\text{-}04Cp^3 + 1.362815E\text{-}07Cp^4$

T(308.66) = 108 T(615.03) = 452 T(662.94) = 686

std error est = 4.5 max error est = 14

Note: For T(Cp) calculations from 700-1365K, use the iterative procedures discussed in Section 5 and the following eqn: 700-1365K, $Cp(T) = 563.12016 + 0.198424T - 7.78963E\text{-}05T^2$.

CARBONYL CHLORIDE FLUORIDE COClF 100-1500K

$Cp(T) = 309.8366 + 0.908395T + 2.14223E\text{-}03T^2 - 7.3825E\text{-}06T^3 + 8.468816E\text{-}09T^4 - 4.393756E\text{-}12T^5 + 8.6745044E\text{-}16T^6$

Cp(100) = 415.52 Cp(800) = 884.22 Cp(1500) = 965.61

std error est = 2.7 max error est = 4.5

CARBONYL FLUORIDE COF_2 100-1500K

$Cp(T) = 500.9343 - 0.685575T + 9.023284E\text{-}03T^2 - 1.958117E\text{-}05T^3 + 1.949097E\text{-}08T^4 - 9.392863E\text{-}12T^5 + 1.769924E\text{-}15T^6$

Cp(100) = 504.88 Cp(800) = 1071.45 Cp(1500) = 1195.03

std error est = 3.9 max error est = 7.5

CARBONYL SULFIDE COS 100-1500K

$Cp(T) = 383.5831 + 1.008813T + 1.13734E\text{-}03T^2 - 5.397317E\text{-}06T^3 + 6.74814E\text{-}09T^4 - 3.689623E\text{-}12T^5 + 7.566326E\text{-}16T^6$

Cp(100) = 491.08 Cp(800) = 908.47 Cp(1500) = 1002.78

std error est = 3.2 max error est = 6.0

CHLORINE - Ideal gas Cl_2 200-590K

$Cp(T) = 333.73754 + 0.7763656T - 1.167902E\text{-}03T^2 + 6.302785E\text{-}07T^3$

Cp(200) = 447.34 Cp(400) = 497.76 Cp(590) = 514.69

std error est = 0.15 max error est = 0.5

590-1365K

$Cp(T) = 459.54857 + 0.1432384T - 9.84775E\text{-}05T^2 + 2.443506E\text{-}08T^3$

Cp(590) = 514.8 Cp(900) = 526.51 Cp(1365) = 533.73

std error est = 0.14 max error est = 0.5

200-590K

$T(Cp) = -164812.69 + 1056.14056Cp - 2.258534Cp^2 + 1.61435E\text{-}03Cp^3$

T(447.34) = 193 T(497.76) = 400 T(514.69) = 581

std error est = 4.5 max error est = 12

Note: For T(Cp) calculations from 590-1365K, use the iterative procedures discussed in Section 5 and the following eqn: 590-1365K, $Cp(T) = 478.47124 + 7.90734E\text{-}02T - 2.858817E\text{-}05T^2$.

CHLORINE (Atomic) Cl 100-1500K

$Cp(T) = 603.43652 - 0.43322T + 3.15819E\text{-}03T^2 - 7.17812E\text{-}06T^3 + 7.4774E\text{-}09T^4 - 3.716555E\text{-}12T^5 + 7.151811E\text{-}16T^6$

Cp(100) = 585.23 Cp(800) = 635.29 Cp(1500) = 611.49

std error est = 1.4 max error est = 2.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 100-1500K, $Cp(T) = 549.25664 + 0.326977T - 3.6189E\text{-}04T^2 + 1.145343E\text{-}07T^3$.

CHLORINE DIOXIDE ClO_2 100-1500K

$Cp(T) = 474.2129 - 0.009513T + 3.445E\text{-}03T^2 - 7.92275E\text{-}06T^3 + 7.90642E\text{-}09T^4 - 3.76735E\text{-}12T^5 + 6.99282E\text{-}16T^6$

Cp(100) = 500.54 Cp(800) = 802.25 Cp(1500) = 855.11

std error est = 1.3 max error est = 2.5

CHLORINE FLUORIDE ClF 250-1500K

$Cp(T) = 415.24 + 0.88853T - 1.27775E\text{-}03T^2 + 9.74189E\text{-}07T^3 - 3.8041674E\text{-}10T^4 + 6.015904E\text{-}14T^5$

Cp(250) = 571.31 Cp(800) = 670.98 Cp(1500) = 691.96

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 464.27264 + 0.54434T - 4.614077E\text{-}04T^2 + 1.3377E\text{-}07T^3$.

CHLORINE MONOXIDE Cl_2O 100-1500K

$Cp(T) = 335.591265 + 0.654343T + 4.97567E\text{-}04T^2 - 2.93811E\text{-}06T^3 + 3.65937E\text{-}09T^4 - 1.95317E\text{-}12T^5 + 3.902384E\text{-}16T^6$

Cp(100) = 403.41 Cp(900) = 640.62 Cp(1500) = 659.25

std error est = 1.2 max error est = 2.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 100-1500K, $Cp(T) = 329.537164 + 0.83896T - 7.41912E\text{-}04T^2 + 2.20666E\text{-}07T^3$.

CHLORINE OXIDE ClO 100-1500K

$Cp(T) = 591.2772 - 0.598616T + 4.16749E\text{-}03T^2 - 8.65076E\text{-}06T^3 + 8.541837E\text{-}09T^4 - 4.10708E\text{-}12T^5 + 7.729816E\text{-}16T^6$

Cp(100) = 565.25 Cp(900) = 711.69 Cp(1500) = 733.55

std error est = 1.5 max error est = 3.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 100-1500K, $Cp(T) = 515.3754 + 0.426933T - 2.91036E\text{-}04T^2 + 6.836113E\text{-}08T^3$.

CHLORINE TRIFLUORIDE ClF_3 250-1500K

$Cp(T) = 80.2859 + 3.96595T - 9.1267E\text{-}03T^2 + 1.184492E\text{-}05T^3 - 8.82973E\text{-}09T^4 + 3.5203E\text{-}12T^5 - 5.80698E\text{-}16T^6$

Cp(250) = 655.24 Cp(900) = 868.87 Cp(1500) = 887.998

std error est = 0.4 max error est = 1.0

CHLORODIFLUOROMETHANE $CHClF_2$ 90-645K

(FREON-22)- Ideal gas

$Cp(T) = 317.0722 + 0.514191T + 5.95107E\text{-}03T^2 - 2.58911E\text{-}05T^3 + 6.22797E\text{-}08T^4 - 8.02754E\text{-}11T^5 + 4.084E\text{-}14T^6$

Cp(90) = 396.31 Cp(400) = 757.51 Cp(645) = 935.32

std error est = 0.4 max error est = 1.0

645-1365K

$Cp(T) = 276.0442 + 1.6021325T - 1.065933E\text{-}03T^2 + 2.585745E\text{-}07T^3$

Cp(645) = 935.35 Cp(900) = 1043.06 Cp(1365) = 1134.52

std error est = 0.2 max error est = 1.0

90-645K

$T(Cp) = 331.0157 - 3.35938Cp + 1.141036E\text{-}02Cp^2 - 1.36494E\text{-}05Cp^3 + 6.06808E\text{-}09Cp^4$

T(396.31) = 92 T(757.51) = 399 T(935.32) = 646

std error est = 1.3 max error est = 3.5

645-1365K

$T(Cp) = 242225.509 - 986.8453Cp + 1.510484Cp^2 - 1.028665E\text{-}03Cp^3 + 2.6358E\text{-}07Cp^4$

CHLORODIFLUOROMETHANE (Continued)

T(935.35) = 644 T(1043.06) = 898 T(1134.52) = 1365

std error est = 1 max error est = 1

CHLORODIFLUOROMETHANE, $CDClF_2$ 100-1000K

MONODEUTERATED

$Cp(T) = 355.67955 - 0.424395T + 1.121936E\text{-}02T^2 - 3.137704E\text{-}05T^3 + 4.13097E\text{-}08T^4 - 2.71585E\text{-}11T^5 + 7.159286E\text{-}15T^6$

Cp(100) = 397.92 Cp(600) = 938.49 Cp(1000) = 1084.09

std error est = 0.6 max error est = 1.0

100-1000K

$T(Cp) = -2810.61 + 21.0917Cp - 6.179567E\text{-}02Cp^2 + 9.22238E\text{-}05Cp^3 - 6.82091E\text{-}08Cp^4 + 2.022326E\text{-}11Cp^5$

T(397.92) = 100 T(938.49) = 598 T(1084.09) = 1000

std error est = 1.3 max error est = 2.5

CHLOROFORM - Ideal gas $CHCl_3$ 100-755K

$Cp(T) = 189.1583 + 1.598713T - 1.340133E\text{-}03T^2 + 5.419056E\text{-}09T^3 + 3.77955E\text{-}10T^4$

Cp(100) = 335.67 Cp(500) = 677.78 Cp(755) = 757.42

std error est = 0.2 max error est = 1.0

755-1365K

$Cp(T) = 402.7039 + 0.7755899T - 4.920244E\text{-}04T^2 + 1.152399E\text{-}07T^3$

Cp(755) = 757.40 Cp(1000) = 801.51 Cp(1365) = 837.72

std error est = 0.2 max error est = 1.0

100-755K

$T(Cp) = 1673.1583 - 14.61295Cp + 4.77988E\text{-}02Cp^2 - 6.568945E\text{-}05Cp^3 + 3.424226E\text{-}08Cp^4$

T(335.67) = 104 T(677.78) = 500 T(757.42) = 753

std error est = 1.8 max error est = 3.5

755-1365K

$T(Cp) = -179838.72 + 710.17532Cp - 0.936808Cp^2 + 4.14539E\text{-}04Cp^3$

T(757.40) = 755 T(801.51) = 1000 T(837.72) = 1365

std error est = 0.8 max error est = 2.5

CHLOROFLUOROMETHANE CH_2ClF 200-1000K

$Cp(T) = 638.4166 - 2.34596T + 1.549633E\text{-}02T^2 - 3.2233E\text{-}05T^3 + 3.40267E\text{-}08T^4 - 1.8304265E\text{-}11T^5 + 3.978875E\text{-}15T^6$

Cp(200) = 580.05 Cp(600) = 1019.35 Cp(1000) = 1257.1

std error est = 0.4 max error est = 1.0

200-1000K

$T(Cp) = -1079.2262 + 4.074Cp - 4.3312E\text{-}03Cp^2 + 1.912603E\text{-}06Cp^3$

T(580.05) = 200 T(1019.35) = 599 T(1257.1) = 997

std error est = 1.4 max error est = 3

CHLOROMETHYLIDYNE CCl 300-1500K

$Cp(T) = 543.19413 + 0.651587T - 7.2857E\text{-}04T^2 + 3.84102E\text{-}07T^3 - 7.77988E\text{-}11T^4$

Cp(300) = 682.84 Cp(800) = 762.97 Cp(1500) = 783.78

std error est = 0.4 max error est = 1.o

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 300-1500K, $Cp(T) = 570.92334 + 0.48166T - 3.8583E\text{-}04T^2 + 1.066284E\text{-}07T^3$.

CHLOROSILANE SiH_3Cl 100-1000K

$Cp(T) = 632.108 - 3.352308T + 2.6872E\text{-}02T^2 - 7.054946E\text{-}05T^3 + 9.37112E\text{-}08T^4 - 6.27597E\text{-}11T^5 + 1.67893E\text{-}14T^6$

Cp(100) = 503.81 Cp(500) = 1013.31 Cp(1000) = 1343.14

std error est = 1.6 max error est = 3.0

CHLOROTRIFLUOROMETHANE $CClF_3$ 200-1090K
(FREON-13) - Ideal gas

$Cp(T) = 77.23115 + 2.79399T - 3.680032E\text{-}03T^2 + 2.4349E\text{-}06T^3 - 6.56569E\text{-}10T^4$

Cp(200) = 507.26 Cp(600) = 869.66 Cp(1090) = 976.9

std error est = 0.3 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 200-1090, $Cp(T) = 137.21148 + 2.290486T - 2.25364E\text{-}03T^2 + 7.92858E\text{-}07T^3$.

CUMENE $C_6H_5CH(CH_3)_2$ 275-1500K

$Cp(T) = 80.85313 + 2.55483T + 1.017634E\text{-}02T^2 - 2.428585E\text{-}05T^3 + 2.32E\text{-}08T^4 - 1.05785E\text{-}11T^5 + 1.8904E\text{-}15T^6$

Cp(275) = 1164.81 Cp(800) = 2735.13 Cp(1500) = 3497.47

std error est = 1.7 max error est = 5

275-1500K

$T(Cp) = 622.8356 - 1.098344Cp + 1.04225E\text{-}03Cp^2 - 3.612275E\text{-}07Cp^3 + 4.95368E\text{-}11Cp^4$

T(1164.81) = 278 T(2735.13) = 797 T(3497.47) = 1489

std error est = 4.0 max error est = 14

CYANOGEN $(CN)_2$ 100-1500K

$Cp(T) = 311.4587 + 4.93727T - 1.16917E\text{-}02T^2 + 1.6521E\text{-}05T^3 - 1.31327E\text{-}08T^4 + 5.4334E\text{-}12T^5 - 9.1145E\text{-}16T^6$

Cp(100) = 703.53 Cp(800) = 1399.67 Cp(1500) = 1563.02

std error est = 1.2 max error est = 2.5

CYANOGEN CHLORIDE CNCl 100-1500K

$Cp(T) = 287.6997 + 2.740703T - 6.197496E\text{-}03T^2 + 8.19973E\text{-}06T^3 - 6.1265E\text{-}09T^4 + 2.39758E\text{-}12T^5 - 3.82468E\text{-}16T^6$

Cp(100) = 507.41 Cp(800) = 888.09 Cp(1500) = 963.14

std error est = 1.1 max error est = 2.5

CYCLOHEXANE - See HEXANE

CYCLOPROPANE - See PROPANE

n-DECANE - Ideal gas $C_{10}H_{22}$ 300-700K

$Cp(T) = 240.7178 + 5.09965T - 6.29026E\text{-}04T^2 - 1.07155E\text{-}06T^3$

Cp(300) = 1685.07 Cp(500) = 2499.34 Cp(700) = 3134.71

std error est = 0.1 max error est = 1.0

700-1365K

$Cp(T) = -13534.589 + 91.4879T - 0.2207T^2 + 2.91406E\text{-}04T^3 - 2.153074E\text{-}07T^4 + 8.386E\text{-}11T^5 - 1.34404E\text{-}14T^6$

Cp(700) = 3134.09 Cp(1000) = 3771.91 Cp(1365) = 4258.15

std error est = 1.2 max error est = 2.0

300-700K

$T(Cp) = -201.2556 + 0.4224556Cp - 1.10665E\text{-}04Cp^2 + 2.15458E\text{-}08Cp^3$

T(1685.07) = 299 T(2499.34) = 500 T(3134.71) = 699

std error est = 0.3 max error est = 1

700-1365K

$T(Cp) = 11052.013 - 13.05146Cp + 5.9256E\text{-}03Cp^2 - 1.1798E\text{-}06Cp^3 + 8.983E\text{-}11Cp^4$

T(3134.09) = 699 T(3771.91) = 998 T(4258.15) = 1362

std error est = 0.5 max error est = 3

n-DEUTERIUM D_2 200-645K

Ideal gas

$Cp(T) = 7264.2197 + 0.037477T - 7.05335E\text{-}04T^2 + 1.51166E\text{-}06T^3$

Cp(200) = 7255.6 Cp(400) = 7264.28 Cp(645) = 7400.59

std error est = 0.2 max error est = 1.0

645-1365K

$Cp(T) = 7583.3708 - 2.017012T + 3.3723E\text{-}03T^2 - 1.080913E\text{-}06T^3$

Cp(645) = 7395.31 Cp(1000) = 7857.75 Cp(1365) = 6364.41

std error est = 0.2 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqns: 200-645K, $Cp(T) = 7353.022 - 0.72328T + 1.2086E\text{-}03T^2$: 645-1365K, $Cp(T) = 6629.115 + 1.06105T + 1.642087E\text{-}04T^2$.

DEUTERIUM (Monatomic) D 55-1500K

Cp(T) = 10.32 - constant

DIBROMOMETHANE CH_2Br_2 300-1000K

$Cp(T) = 104.624 + 0.911614T - 7.67807E\text{-}04T^2 + 2.58695E\text{-}07T^3$
Cp(300) = 315.99 Cp(600) = 431.06 Cp(1000) = 507.13
std error est = 0.3 max error est = 1.0

300-1000K

$T(Cp) = -2029.747 + 17.57971Cp - 4.78704E\text{-}02Cp^2 + 4.927377E\text{-}05Cp^3$
T(315.99) = 300 T(431.06) = 600 T(507.13) = 1001
std error est = 0.7 max error est = 1.5

DICHLORODIFLUOROMETHANE 100-1365K CCl_2F_2
(FREON-12) - Ideal gas

$Cp(T) = 115.7338 + 2.37887T - 2.812186E\text{-}03T^2 + 5.571888E\text{-}07T^3 + 1.82207E\text{-}09T^4 - 1.6317E\text{-}12T^5 + 4.2395E\text{-}16T^6$

Cp(100) = 326.22 Cp(800) = 827.04 Cp(1365) = 875.74
std error est = 0.3 max error est = 1.0

1,1-DICHLORO-1-FLUORO- 300-600K CH_3CFCl_2
ETHANE

Cp(T) = 474 + 1.0T T(Cp) = Cp -474
Note: There are only three (3) data points available from the reference source. The accuracy cannot be adequately established.

DICHLOROFLUOROMETHANE 100-755K $CHCl_2F$
(FREON-21) - Ideal gas

$Cp(T) = 209.72 + 1.79069T - 3.45786E\text{-}03T^2 + 1.0810155E\text{-}05T^3 - 2.22979E\text{-}08T^4 + 2.16214E\text{-}11T^5 - 7.79904E\text{-}15T^6$

Cp(100) = 362.999 Cp(450) = 720.25 Cp(755) = 857.42
std error est = 0.3 max error est = 1.0

755-1365K

$Cp(T) = 388.2867 + 1.023759T - 6.4682E\text{-}04T^2 + 1.50429E\text{-}07T^3$
Cp(755) = 857.26 Cp(1000) = 915.65 Cp(1365) = 963.13
std error est = 0.2 max error est = 1.0

100-755K

$T(Cp) = 921.3768 - 7.7154Cp + 2.414285E\text{-}02Cp^2 - 3.033265E\text{-}05Cp^3 + 1.446893E\text{-}08Cp^4$

T(362.99) = 102 T(720.25) = 449 T(857.42) = 755
std error est = 1.1 max error est = 2.0

755-1365K

$T(Cp) = -122177 + 424.7354Cp - 0.493077Cp^2 + 1.923554E\text{-}04Cp^3$
T(857.26) = 755 T(915.65) = 999 T(963.13) = 1364
std error est = 1.1 max error est = 2.0

DICHLOROFLUOROMETHANE, 100-1000K $CDCl_2F$
MONODEUTERATED

$Cp(T) = 255.720254 + 0.689369T + 4.583258E\text{-}03T^2 - 1.3455115E\text{-}05T^3 + 1.377348E\text{-}08T^4 - 4.9189282E\text{-}12T^5$

Cp(100) = 358.36 Cp(500) = 771.46 Cp(1000) = 927.78

std error est = 5.8 max error est = 10

DICHLOROMETHANE CH_2Cl_2 275-1500K

$Cp(T) = 132.0712 + 2.141377T - 2.08642E\text{-}03T^2 + 1.059563E\text{-}06T^3 - 2.15869E\text{-}10T^4$

Cp(275) = 583.97 Cp(800) = 963.94 Cp(1500) = 1132.88

std error est = 0.9 max error est = 2.0

275-1500K

$T(Cp) = 5523.4 - 29.33479Cp + 5.93745E\text{-}02Cp^2 - 5.22736E\text{-}05Cp^3 + 1.760695E\text{-}08Cp^4$

T(583.97) = 278 T(963.94) = 797 T(1132.88) = 1491

std error est = 5.0 max error est = 9

1,1-DICHLOROTETRAFLUORO- 275-600K CCl_2FCF_3
ETHANE

$Cp(T) = -104.2484 + 4.520335T - 8.19256E\text{-}03T^2 + 5.7332E\text{-}06T^3$

Cp(275) = 638.51 Cp(450) = 793.35 Cp(600) = 897.00

std error est = 0.01 max error est = 0.5

275-600K

$T(Cp) = 421.358 - 1.292708Cp + 1.66326E\text{-}03Cp^2$

T(638.51) = 274 T(793.35) = 443 T(897.00) = 600

std error est = 1.4 max error est = 2.5

DICHLOROTETRAFLUORO- 220-510K $C_2Cl_2F_4$
ETHANE (FREON-114)

$Cp(T) = -94.71864 + 4.57011T - 7.699598E\text{-}03T^2 + 4.89705E\text{-}06T^3$

Cp(220) = 590.19 Cp(400) = 814.8 Cp(510) = 882.97

std error est = 0.2 max error est = 1.0

220-510K

$T(Cp) = -1652.37 + 7.94254Cp - 1.184297E\text{-}02Cp^2 + 6.36623E\text{-}06Cp^3$

T(590.19) = 219 T(814.8) = 400 T(882.97) = 510

std error est = 0.5 max error est = 1.5

2,2-DICHLORO-1,1,1-TRI- 200-800K F_3CCHCl_2
FLUOROETHANE

$Cp(T) = 1319.2995 - 14.01811T + 8.407976E\text{-}02T^2 - 2.15252E\text{-}04T^3 + 2.57008E\text{-}07T^4 - 1.15831E\text{-}10T^5$

Cp(200) = 530.999 Cp(500) = 866.97 Cp(800) = 1021.81

std error = 0.5 max error est = 2.5*

*Note: Cp(700) = 1114.17 but table value is 984.

1,1-DIFLUOROETHYLENE CH_2CF_2 175-1175K

$Cp(T) = 472.82 - 1.09967T + 1.798667E\text{-}02T^2 - 4.64504E\text{-}05T^3 + 5.802696E\text{-}08T^4 - 3.622937E\text{-}11T^5 + 8.981685E\text{-}15T^6$

Cp(175) = 631.01 Cp(600) = 1377.09 Cp(1175) = 1760.59

std error est = 4.4 max error est = 8

DIFLUOROMETHANE CH_2F_2 200-1000K

$Cp(T) = 926.6998 - 4.228109T + 2.28603E\text{-}02T^2 - 4.39433E\text{-}05T^3 + 4.39172E\text{-}08T^4 - 2.27523E\text{-}11T^5 + 4.84046E\text{-}15T^6$

Cp(200) = 707.24 Cp(500) = 1144.26 Cp(1000) = 1620.95

std error est = 0.5 max error est = 1.0

200-1000K

$T(Cp) = -1024.354 + 3.046388Cp - 2.430315E\text{-}03Cp^2 + 8.15023E\text{-}07Cp^3$

T(707.24) = 203 T(1144.26) = 500 T(1620.95) = 999

std error est = 1.5 max error est = 3.5

DIMETHYLAMINE $(CH_3)_2NH$ 275-1475K

$Cp(T) = 843.8386 - 1.419\ 1273T + 2.18139E\text{-}02T^2 - 4.059054E\text{-}05T^3 + 3.603484E\text{-}08T^4 - 1.5961557E\text{-}11T^5 + 2.82084E\text{-}15T^6$

Cp(275) = 1441.30 Cp(800) = 3156.13 Cp(1475) = 4128.28

std error est = 2.4 max error est = 4.5

275-1475K

$T(Cp) = 389.02765 - 0.587004715Cp + 5.4705492E\text{-}04Cp^2 - 1.6211353E\text{-}07Cp^3 + 1.92366E\text{-}11Cp^4$

T(1441.30) = 277 T(3156.13) = 798 T(4128.28) = 1471

std error est = 3.5 max error est = 6

2,2-DIMETHYLBUTANE $CH_3CH_2C(CH_3)_3$ 300-1000K

$Cp(T) = 2581.4188 - 21.863667T + 0.11908912T^2 - 2.667096E\text{-}04T^3 + 3.179459E\text{-}07T^4 - 1.9721679E\text{-}10T^5 + 5.005353E\text{-}14T^6$

Cp(300) = 1671.79 Cp(600) = 2931.54 Cp(1000) = 3879.91

std error est = 1.8 max error est = 2.5

300-1000K

$T(Cp) = -245.69753 + 0.521407Cp - 1.6592016E\text{-}04Cp^2 + 2.9471092E\text{-}08Cp^3$

T(1671.79) = 300 T(2931.54) = 599 T(3879.91) = 1001

std error est = 1.6 max error est = 2.5

2,3-DIMETHYLBUTANE $[(CH_3)_2CH]_2$ 300-1000K

$Cp(T) = 734.10753 - 0.560625T + 2.23453E\text{-}02T^2 - 4.17216E\text{-}05T^3 + 3.25804E\text{-}08T^4 - 9.52277E\text{-}12T^5$

Cp(300) = 1691.27 Cp(600) = 2912.1 Cp(1000) = 3854.81

std error est = 2.2 max error est = 4.5

2,3-DIMETHYLBUTANE (Continued) 300-1000K

$T(Cp) = -218.0723 + 0.473152Cp - 1.438724E\text{-}04Cp^2 + 2.6738645E\text{-}08Cp^3$

T(1691.27) = 300 T(2912.1) = 600 T(3854.81) = 1000

std error est = 0.7 max error est = 1.5

2,3-DIMETHYLHEXANE 395-520K

$(CH_3)_2CHCH(CH_3)(CH_2)_2CH_3$

$Cp(T) = 605.9 + 3.8822T$ T(Cp) = [Cp - 605.9]/3.8822

Note: There are only three data points in the reference source. The accuracy of the fits cannot be adequately estimated.

3,4-DIMETHYLHEXANE 405-520K

$[CH(CH_3)CH_2CH_3]_2$

$Cp(T) = 594.01 + 3.881T$ T(Cp) = [Cp-594.01]/3.881

Nore: There are only three data points in the reference source. The accuracy of the fits cannot be adequately estimated.

DIMETHYLPROPANE $C(CH_3)_4$ 300-1500K

$\ln[Cp(T)] = 6.1724277 + 5.9032424E\text{-}03T - 6.648126E\text{-}06T^2 + 3.6018484E\text{-}09T^3 - 7.508868E\text{-}13T^4$

**Cp(T) = exp[fctn(T)]

Cp(300) = 1696.35 Cp(800) = 3557.47 Cp(1500) = 4554.55

std error est = 8.00674E-03 for ln[Cp(T)]

DIPROPYLENE GLYCOL $(CH_3CHOHCH_2)_2O$ 275-775K

$Cp(T) = -1826.75484 + 36.04835T - 0.1900801T^2 + 5.610031E\text{-}04T^3 - 9.03165E\text{-}07T^4 + 7.46426E\text{-}10T^5 - 2.482783E\text{-}13T^6$

Cp(275) = 1280.09 Cp(500) = 1801.43 Cp(775) = 2155.97

std error est = 2.8 max error est = 3.5

275-775K

$T(Cp) = -395.8809 + 0.389689Cp + 5.172082E\text{-}04Cp^2 - 4.901004E\text{-}07Cp^3 + 1.31177E\text{-}10Cp^4$

T(1280.09) = 275 T(1801.43) = 501 T(2155.97) = 771

std error est = 2.4 max error est = 5

DODECANE $CH_3(CH_2)_{10}CH_3$ 300-1500K

$Cp(T) = 827.74543 - 0.177414T + 1.89547E\text{-}02T^2 - 3.681404E\text{-}05T^3 + 3.299875E\text{-}08T^4 - 1.45863E\text{-}11T^5 + 2.55543E\text{-}15T^6$

Cp(300) = 1720.17 Cp(800) = 3374.57 Cp(1500) = 4361.72

std error est = 5.0 max error est = 7.5

300-1500K

$T(Cp) = 867.5699 - 1.28664Cp + 8.801372E\text{-}04Cp^2 - 2.28373E\text{-}07Cp^3 + 2.333242E\text{-}11Cp^4$

T(1720.17) = 301 T(3374.57) 798 T(4361.72) = 1496

std error est = 4.5 max error est = 7.5

ETHANE - Ideal gas C_2H_6 275-755K

$Cp(T) = 531.9795 + 3.755877T + 1.789289E\text{-}03T^2 - 2.13225E\text{-}06T^3$
Cp(275) = 1655.82 Cp(500) = 2590.71 Cp(755) = 3469.95
std error est = 0.1 max error est = 1.0

755-1365K

$Cp(T) = 3718.3729 - 10.891558T + 2.95115E\text{-}02T^2 - 2.95597E\text{-}05T^3 + 1.382794E\text{-}08T^4 - 2.52553E\text{-}12T^5$
Cp(755) = 3469.49 Cp(1000) = 4081.02 Cp(1365) = 4696.05
std error est = 0.4 max error est = 1.0

275-755K

$T(Cp) = 26.69485 - 0.0209973Cp + 1.77038E\text{-}04Cp^2 - 5.60605E\text{-}08Cp^3 + 6.976759E\text{-}12Cp^4$
T(1655.82) = 275 T(2590.71) = 500 T(3469.95) = 755
std error est = 0.2 max error est = 1

755-1365K

$T(Cp) = -3405.9176 + 2.9438457Cp - 7.63789E\text{-}04Cp^2 + 7.521499E\text{-}08Cp^3$
T(3469.49) = 755 T(4081.02) = 1000 T(4696.05) = 1364
std error est = 0.5 max error est = 1.5

ETHANE , HEXADEUTERATED C_2D_6 275-365K

$Cp(T) = 1100.6747 - 3.438783T + 2.9385375E\text{-}02T^2 - 3.3966273E\text{-}05T^3$
Cp(275) = 1670.89 Cp(315) = 1871.58 Cp(365) = 2108.7
std error est = 0.1 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the polynomial above.

ETHANETHIOL C_2H_5SH 300-1000K

$Cp(T) = 357.285 + 2.59852T + 1.61883E\text{-}03T^2 - 4.13005E\text{-}06T^3 + 1.930025E\text{-}09T^4$
Cp(300) = 1186.66 Cp(700) = 2016.27 Cp(1000) = 2374.61
std error est = 5.5 max error est = 9.5

300-1000K

$T(Cp) = -340.822 + 0.8964337Cp - 4.606323E\text{-}04Cp^2 + 1.352216E\text{-}07Cp^3$
T(1186.66) = 300 T(2016.27) = 702 T(2374.61) = 1001
std error est = 4.8 max error est = 6.5

ETHYL ACETATE $CH_3COOCH_2CH_3$ 370-440K

$Cp(T) = -1312.0132 + 11.8064T - 1.1402197E\text{-}02T^2$
Cp(370) = 1495.39 Cp(400) = 1586.2 Cp(440) = 1675.34
std error est = 8.3 max error est = 15

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the equation above. The T(Cp) calculations may not agree well due to the std error ests above.

ETHYL ALCOHOL C_2H_5OH 255-810K

Ideal gas

$Cp(T) = 546.2212 + 3.8600396T - 1.023837E\text{-}03T^2 - 2.75659E\text{-}07T^3$

Cp(255) = 1459.39 Cp(500) = 2185.82 Cp(810) = 2854.62

std error est = 0.3 max error est = 1.5

810-1365K

$Cp(T) = 835.49557 + 3.1089285T - 4.372953E\text{-}04T^2 - 5.607147E\text{-}07T^3 + 2.0162334E\text{-}10T^4$

Cp(810) = 2855.62 Cp(1100) = 3275.08 Cp(1365) = 3538.29

std error est = 0.2 max error est = 1.0

255-810K

$T(Cp) = -394.5867 + 0.668288Cp - 2.236847E\text{-}04Cp^2 + 4.805682E\text{-}08Cp^3$

T(1459.39) = 254 T(2185.82) = 499 T(2854.62) = 808

std error est = 0.7 max error est = 2

810-1365K

$T(Cp) = -7130.17 + 7.512807Cp - 2.545385E\text{-}03Cp^2 + 3.11057E\text{-}07Cp^3$

T(2855.62) = 810 T(3275.08) = 1100 T(3538.29) = 1364

std error est = 0.2 max error est = 2

ETHYLBENZENE $C_6H_5C_2H_5$ 275-1500K

$Cp(T) = 88.81893 + 2.2813924T + 1.0434866E\text{-}02T^2 - 2.431028E\text{-}05T^3 + 2.3069044E\text{-}08T^4 - 1.0491076E\text{-}11T^5 + 1.87293E\text{-}15T^6$

Cp(275) = 1116.01 Cp(800) = 2647.73 Cp(1500) = 3396.43

std error est = 1.9 max error est = 6

275-1500K

$T(Cp) = 642.15192 - 1.1750234Cp + 1.1452373E\text{-}03Cp^2 - 4.0876E\text{-}07Cp^3 + 5.746896E\text{-}11Cp^4$

T(1116.01) = 278 T(2647.73) = 797 T(3396.43) = 1495

std error est = 3.9 max error est = 8

ETHYL ETHER $C_4H_{10}O$ 310-600K

$Cp(T) = -4053.47326 + 33.471276T - 6.7641844E\text{-}02T^2 + 5.094208E\text{-}05T^3$

Cp(310) = 1339.87 Cp(450) = 1953.22 Cp(600) = 2681.72

std error est = 0.2 max error est = 1.0

310-600K

$T(Cp) = 779.23434 - 1.052998Cp + 6.81429E\text{-}04Cp^2 - 1.17146E\text{-}07Cp^3$

T(1339.87) = 310 T(1953.22) = 449 T(2681.72) = 597

std error est = 1.5 max error est = 3

ETHYLENE - Ideal gas C_2H_4 275-755K

$Cp(T) = 248.817245 + 4.864076T - 1.570483E\text{-}03T^2 - 2.3772E\text{-}07T^3$

Cp(275) = 1462.73 Cp(500) = 2258.52 Cp(755) = 2923.67

std error est = 0.2 max error est = 1.0

ETHYLENE - Ideal gas (continued) 755-1365K

$Cp(T) = 883.873 + 2.982773T + 2.684874E\text{-}04T^2 - 1.103103E\text{-}06T^3 + 3.3579064E\text{-}10T^4$

Cp(755) = 2923.28 Cp(1000) = 3367.82 Cp(1365) = 3815.82

std error est = 0.3 max error est = 1.0

275-755K

$T(Cp) = -215.2115 + 0.46972Cp - 1.376816E\text{-}04Cp^2 + 3.0917277E\text{-}08Cp^3$

T(1462.73) = 274 T(2258.52) = 500 T(2923.67) = 754

std error est = 0.5 max error est = 2

755-1365K

$T(Cp) = -4851.525 + 4.91917Cp - 1.56526E\text{-}03Cp^2 + 1.842345E\text{-}07Cp^3$

T(2923.28) = 755 T(3367.82) = 999 T(3815.82) = 1364

std error est = 0.5 max error est = 1

ETHYLENE - Real gas 275-610K

$Cp(T) = 452.40453 + 3.594527T + 1.099394E\text{-}03T^2 - 2.103391E\text{-}06T^3$

Cp(275) = 1480.3 Cp(450) = 2100.9 Cp(610) = 2576.72

std error est = 1.5 max error est = 2.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the polynomial immediately above.

ETHYLENE OXIDE $(CH_2)_2O$ 275-1000K

$Cp(T) = 1405.23696 - 8.747353T + 4.235163E\text{-}02T^2 - 6.972269E\text{-}05T^3 + 5.2382475E\text{-}08T^4 - 1.5060405E\text{-}11T^5$

Cp(275) = 1028.44 Cp(600) = 1960.98 Cp(1000) = 2608.89

std error est = 5.0 max error est = 7.5

275-1365K

$T(Cp) = -324.12166 + 0.929479Cp - 4.506574E\text{-}04Cp^2 + 1.107183E\text{-}07Cp^3$

T(1028.44) = 276 T(1960.98) = 600 T(2608.89) = 999

std error est = 1.5 max error est = 3

3-ETHYLHEXANE $(CH_3CH_2)_2CH(CH_2)_2CH_3$ 295-520K

$Cp(T) = 1559.9 + 1.928T$ $T(Cp) = [Cp - 1559.9]/1.928$

Note: There are only three data points in the reference source. The accuracy of the fit cannot be adequately established.

3-ETHYL-2-METHYL-PENTANE $(CH_3)_2CHCH(C_2H_5)_2$ 400-520K

$Cp(T) = 658.8 + 3.7806T$ $T(Cp) = [Cp-658.8]/3.7806$

Note: There are only three data points in the reference source. The accuracy of the fit cannot be adequately established.

3-ETHYL-3-METHYL-PENTANE $(CH_3CH_2)_3CCH_3$ 400-520K

$Cp(T) = 641.9 + 3.8767T$ $T(Cp) = [Cp - 641.9]/3.8767$

Note: There are only three data points in the reference source. The accuracy of the fit cannot be adequately established.

FLUORINE F_2 200-645K

Ideal gas

$Cp(T) = 658.25722 + 0.6751476T - 3.79745E\text{-}04T^2 + 2.235484E\text{-}09T^3$

Cp(200) = 778.11 Cp(450) = 885.38 Cp(645) = 936.34

std error est = 0.01 max error est = 1.0

645-1365K

$Cp(T) = 127.23948 + 3.72368T - 7.033226E\text{-}03T^2 + 6.867834E\text{-}06T^3 - 3.366543E\text{-}09T^4 + 6.5637923E\text{-}13T^5$

Cp(645) = 936.51 Cp(1000) = 975.36 Cp(1365) = 995.65

std error est = 0.3 max error est = 1.0

200-645K

$T(Cp) = 3954.34 - 11.05956Cp + 8.024798E\text{-}03Cp^2$

T(778.11) = 207 T(885.38) = 453 T(936.34) = 634

std error est = 5.0 max error est = 11

645-1365K

$T(Cp) = 112357.756 - 242.565496Cp + 0.131647Cp^2$

T(936.51) = 654 T(975.36) = 1008 T(995.65) = 1351

std error est = 7.5 max error est = 15.5

FLUORINE (Monatomic) F 100-1500K

$Cp(T) = 925.04634 + 2.7925687T - 1.038958E\text{-}02T^2 + 1.78943E\text{-}05T^3 - 1.6070342E\text{-}08T^4 + 7.28505E\text{-}12T^5 - 1.315903E\text{-}15T^6$

Cp(100) = 1116.77 Cp(800) = 1131.45 Cp(1500) = 1106.39

std error est = 1.7 max error est = 3.5

FLUOROETHANE CH_3CH_2F 100-1500K

$\ln[Cp(T)] = 6.471145519 + 2.09924177E\text{-}03T + 1.99348096E\text{-}06T^2 - 5.55076164E\text{-}09T^3 + 3.8054008E\text{-}12T^4 - 8.6180454E\text{-}16T^5$

Cp(100) = 809.02 Cp(800) = 2593.26 Cp(1500) = 3268.33

std error est = 10.0 max error est = 85

**Note: Cp(T) = exp[fctn(T)]

FLUOROETHYLENE CH_2CHF 175-975K

$Cp(T) = 580.68945 - 1.7973376T + 2.027156E\text{-}02T^2 - 4.167712E\text{-}05T^3 + 3.705407E\text{-}08T^4 - 1.2304487E\text{-}11T^5$

Cp(175) = 696.34 Cp(600) = 1643.20 Cp(975) = 2113.99

std error est = 7.1 max error est = 13.5

175-975K

$T(Cp) = -171.8982 + 0.671097Cp - 3.337414E\text{-}04Cp^2 + 1.285454E\text{-}07Cp^3$

T(696.34) = 177 T(1643.20) = 600 T(2113.99) = 970

std error est = 5.5 max error est = 10

FLUOROFORM, MONODEUTERATED CF_3D 100-1000K

$Cp(T) = 529.7845 - 1.9731807T + 1.8510456E\text{-}02T^2 - 4.45372E\text{-}05T^3 + 5.268778E\text{-}08T^4 - 3.146596E\text{-}11T^5 + 7.57734E\text{-}15T^6$

Cp(100) = 477.99 Cp(600) = 1124.68 Cp(1000) = 1329.02

std error est = 0.6 max error est = 1.0

100-1000K

$T(Cp) = -134.042 - 0.440011Cp + 3.65192E\text{-}03Cp^2 - 4.4091204E\text{-}06Cp^3 + 1.799033E\text{-}09Cp^4$

T(477.99) = 102 T(1124.68) = 596 T(1329.02) = 994

std error est = 5.8 max error est = 10

FLUOROMETHANE CH_3F 200-1000K

$Cp(T) = 1472.3652 - 6.384875T + 0.0269437T^2 - 4.020256E\text{-}05T^3 + 2.816384E\text{-}08T^4 - 7.7050064E\text{-}12T^5$

Cp(200) = 994.09 Cp(600) = 1708.08 Cp(1000) = 2289.27

std error est = 0.8 max error est = 2.5

200-1000K

$T(Cp) = -2770.3792 + 6.5625134Cp - 5.26989E\text{-}03Cp^2 + 1.946297E\text{-}06Cp^3 - 2.543208E\text{-}10Cp^3$

T(994.09) = 209 T(1708.08) = 598 T(2289.27) = 1000

std error est = 4.7 max error est = 9.5

FORMALDEHYDE HCHO 275-1500K

$Cp(T) = 1410.7255 - 3.85954T + 1.56866E\text{-}02T^2 - 2.25445E\text{-}05T^3 + 1.689E\text{-}08T^4 - 6.5741125E\text{-}12T^5 + 1.049515E\text{-}15^6$

Cp(275) = 1153.51 Cp(800) = 1858.8 Cp(1500) = 2366.67

std error est = 2.0 max error est = 4.5

275-1500K

$T(Cp) = -302.25 - 0.79339952Cp + 2.386302E\text{-}03Cp^2 - 1.438642E\text{-}06Cp^3 + 2.990445E\text{-}10Cp^4$

T(1153.51) = 279 T(1858.8) = 798 T(2366.67) = 1497

std error est = 3.9 max error est = 7

FORMYL HCO 300-1000K

$Cp(T) = 978.65 + 0.6283T$ $T(Cp) = [Cp - 978.65]/0.6283$

Note: There are only two data points in the reference source. The accuracy of this fit cannot be adequately established.

FURAN C_4H_4O 45-100K

$Cp(T) = 1099.8 + 1.3061T$ $T(Cp) = [Cp - 1099.8]/1.3061$

Note: There are only three data points in the reference source. The accuracy of the fit cannot be adequately established.

HELIUM He ALL TEMPERATURES

Cp(T) = 519.31 = Constant

n-HEPTANE - Ideal gas C_7H_{16} 300-755K

$Cp(T) = 94.626 + 5.860997T - 1.9823132E\text{-}03T^2 - 6.886993E\text{-}08T^3 - 1.9379526E\text{-}10T^4$

Cp(300) = 1671.09 Cp(500) = 2508.83 Cp(755) = 3297.1

std error est = 0.2 max error est = 1.0

755-1365K

$Cp(T) = -740.308 + 10.893537T - 1.265124E\text{-}02T^2 + 9.843763E\text{-}06T^3 - 4.3228296E\text{-}09T^4 + 7.863665E\text{-}13T^5$

Cp(755) = 3297.54 Cp(1000) = 3809.29 Cp(1365) = 4312.15

std error est = 0.3 max error est = 1.0

300-755K

$T(Cp) = -194.613 + 0.4265268Cp - 1.1575878E\text{-}04Cp^2 + 2.2332567E\text{-}08Cp^3$

T(1671.09) = 299 T(2508.83) = 500 T(3297.1) = 754

std error est = 0.5 max error est = 1.5

755-1365K

$T(Cp) = -4882.496 + 4.4329699Cp - 1.260663E\text{-}03Cp^2 + 1.318505E\text{-}07Cp^3$

T(3297.54) = 755 T(3809.29) = 999 T(4312.15) = 1364

std error est = 0.9 max error est = 2.5

HEXAFLUOROETHANE $(CF_3)_2$ 175-1175K

$Cp(T) = 659.43 - 2.9660847T + 2.168867E\text{-}02T^2 - 4.922597E\text{-}05T^3 + 5.4905868E\text{-}08T^4 - 3.068691E\text{-}11T^5 + 6.876342E\text{-}15T^6$

Cp(175) = 587.42 Cp(675) = 1148.43 Cp(1175) = 1286.31

std error est = 4.9 max error est = 11.0

n-HEXANE - Ideal gas C_6H_{14} 275-755K

$Cp(T) = 244.084 + 5.0862655T - 5.31415E\text{-}04T^2 - 1.0882839E\text{-}06T^3$

Cp(275) = 1579.99 Cp(500) = 2518.33 Cp(755) = 3312.93

std error est = 0.2 max error est = 1.0

755-1365K

$Cp(T) = 4009.13 - 11.718687T + 0.0298761T^2 - 2.9593554E\text{-}05T^3 + 1.375164E\text{-}08T^4 - 2.4932142E\text{-}12T^5$

Cp(755) = 3312.16 Cp(1000) = 3831.41 Cp(1365) = 4339.26

std error est = 0.7 max error est = 2.0

275-755K

$T(Cp) = -209.84 + 0.4334954Cp - 1.1488097E\text{-}04Cp^2 + 2.167164E\text{-}08Cp^3$

T(1579.99) = 274 T(2518.33) = 499 T(3312.93) = 753

std error est = 0.6 max error est = 2.5

755-1365K

$T(Cp) = -5668.09 + 5.032992Cp - 1.41023E\text{-}03Cp^2 + 1.437634E\text{-}07Cp^3$

T(3312.16) = 755 T(3831.41) = 999 T(4339.26) = 1364

n-HEXANE (continued)

std error est = 0.6 max error est = 2.5

CYCLOHEXANE C_6H_{12} 300-1500K

$Cp(T) = -143.687 + 2.2338877T + 1.5757957E\text{-}02T^2 - 3.322767E\text{-}05T^3 + 2.992193E\text{-}08T^4 - 1.3118055E\text{-}11T^5 + 2.278605E\text{-}15T^6$

Cp(300) = 1259.7 Cp(800) = 3270.77 Cp(1500) = 4338.44

std error est = 2.0 max error est = 3.5

300-1500K

$T(Cp) = 493.2108 - 0.6186162Cp + 5.38728E\text{-}04Cp^2 - 1.568782E\text{-}07Cp^3 + 1.7939201E\text{-}11Cp^4$

T(1259.7) = 300 T(3270.77) = 797 T(4338.44) = 1494

std error est = 4.5 max error est = 10.0

HYDRAZINE N_2H_4 275-1475K

$Cp(T) = 164.415 + 6.9555374T - 7.864965E\text{-}03T^2 + 4.8061401E\text{-}06T^3 - 1.14436786E\text{-}09T^4$

Cp(275) = 1575.81 Cp(675) = 2516.48 Cp(1475) = 3319.06

std error est = 4.3 max error est = 6.5

275-1475K

$T(Cp) = -382.0766 + 0.7822092Cp - 3.7974324E\text{-}04Cp^2 + 9.376375E\text{-}08Cp^3$

T(1575.81) = 274 T(2516.48) = 676 T(3319.06) = 1459

std error est = 7.5 max error est = 16.0

HYDROBROMIC ACID HBr 350-1500K

$Cp(T) = 395.3995 - 0.2258915T + 4.5013067E\text{-}04T^2 - 2.807402E\text{-}07T^3 + 6.0719708E\text{-}11T^4$

Cp(350) = 360.35 Cp(850) = 387.9 Cp(1500) = 429.25

std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 350-1500K, $Cp(T) = 333.6168303 + 6.18710596E\text{-}02T + 2.6754517E\text{-}06T^2$.

HYDROCYANIC ACID HCN 100-1500K

$Cp(T) = 1044.92 - 0.430188124T + 9.2162939E\text{-}03T^2 - 2.1505599E\text{-}05T^3 + 2.29172856E\text{-}08T^4 - 1.1686957E\text{-}11T^5 + 2.3027052E\text{-}15T^6$

Cp(100) = 1074.74 Cp(800) = 1749.31 Cp(1500) = 2055.08

std error est = 7.2 max error est = 16.5

100-1500K

$T(Cp) = -52339.698 + 171.0170866Cp - 0.2213524775Cp^2 + 1.4203695E\text{-}04Cp^3 - 4.51189157E\text{-}08Cp^4 + 5.7079687E\text{-}12Cp^5$

T(1074.74) = 95 T(1749.31) = 796 T(2055.08) = 1507

std error est = 1.5 max error est = 7.5

HYDROFLUORIC ACID HF 100-1500K

$Cp(T) = 1460.773641 - 0.081301137T + 4.32324705E\text{-}04T^2 - 1.12701828E\text{-}06T^3 + 1.51594969E\text{-}09T^4 - 8.75540737E\text{-}13T^5 + 1.82375488E\text{-}16T^6$

Cp(100) = 1455.98 Cp(800) = 1477.23 Cp(1500) = 1611.09
std error est = 0.4 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 100-1500K, $Cp(T) = 1464.2305292 - 0.0715176125T + 1.1488975E\text{-}04T^2$.

HYDROFLUORIC ACID, MONODEUTERATED DF 300-1500K

$Cp(T) = 1317.953085 + 0.736930447T - 2.979053E\text{-}03T^2 + 5.585763E\text{-}06T^3 - 4.8632489E\text{-}09T^4 + 2.04262374E\text{-}12T^5 - 3.37598227E\text{-}16T^6$

Cp(300) = 1387.06 Cp(800) = 1449.66 Cp(1500) = 1617.95
std error est = 0.4 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 300-1500K, $Cp(T) = 1444.09476 - 0.35547209T + 6.1254815E\text{-}04T^2 - 1.9925363E\text{-}07T^3$.

HYDROGEN - Ideal gas H_2 100-425K

$Cp(T) = 5006.6253 + 101.569422T - 0.602891517T^2 + 2.7375894E\text{-}03T^3 - 8.4758275E\text{-}06T^4 + 1.43800374E\text{-}08T^5 - 9.8072403E\text{-}12T^6$

Cp(100) = 11158.65 Cp(325) = 14334.47 Cp(425) = 14498.83
std error est = 3.2 max error est = 6.5

490-1365K

$Cp(T) = 14920.082 - 1.996917584T + 2.540615E\text{-}03T^2 - 4.7588954E\text{-}07T^3$

Cp(490) = 14495.61 Cp(850) = 14766.04 Cp(1365) = 15717.7
std error est = 1.3 max error est = 4

Note: For temperatures between 425-490, Cp = 14494.7 - constant.

HYDROGEN - Real gas 100-365K

$Cp(T) = 6436.5105 + 63.161307T - 0.1685728T^2 + 1.5229265E\text{-}04T^3$

Cp(100) = 11219.21 Cp(225) = 13848.52 Cp(365) = 14437.83
std error est = 1.2 max error est = 2

365-475K

$Cp(T) = 29616.406 - 51.4939245T + 0.304123881T^2 - 4.2495904E\text{-}03T^3 + 1.9472701E\text{-}05T^4 - 3.55632306E\text{-}08T^5 + 2.30568584E\text{-}11T^6$

Cp(365) = 14440.87 Cp(425) = 14506.73 Cp(475) = 14512.49

HYDROGEN - Real gas (continued)
std error est = 2.0 max error est = 4.5

475-1255K

$Cp(T) = 15009.352 - 2.2923455T + 2.869303E\text{-}03T^2 - 5.937169E\text{-}07T^3$

Cp(475) = 14504.24 Cp(875) = 14802.62 Cp(1255) = 15478.11
std error est = 1.3 max error est = 5.5

HYDROGEN (Monatomic) H 100-1500K

Cp(T) = 20622 - constant

HYDROGEN, MONODEUTERATED HD 0-1500K

$Cp(T) = 9648.403 + 0.180166208T - 4.410482E\text{-}04T^2 + 3.02156\text{-}1E\text{-}05T^3 - 2.37468746E\text{-}09T^4 + 5.54340759E\text{-}13T^5$

Cp(1) = 9648.58 Cp(800) = 10266.28 Cp(1500) = 11311.73
std error est = 0.6 max error est = 1.5

HYDROGEN CHLORIDE HCl 365-1365K

Ideal gas

$Cp(T) = 770.99488 + 0.26534577T - 9.9858498E\text{-}04T^2 + 1.7010329E\text{-}06T^3 - 1.1455977E\text{-}09T^4 + 2.736703E\text{-}13T^5$

Cp(365) = 798.97 Cp(850) = 843.13 Cp(1365) = 918.63
std error est = 0.3 max error est = 1.0
Note: From 255-365K, Cp = 798.84 - constant.

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 365-1365K, $Cp(T) = 841.8819 - 0.2461627T + 4.0609005E\text{-}04T^2 - 1.3558119E\text{-}07T^3$.

HYDROGEN IODIDE - Ideal gas HI 275-1365K

$Cp(T) = 248.5266 - 0.15405244T + 3.53994265E\text{-}04T^2 - 2.5054778E\text{-}07T^3 + 6.12525942E\text{-}11T^4$

Cp(275) = 228.07 Cp(875) = 252.82 Cp(1365) = 273.24
std error est = 0.2 max error est = 1.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 275-1365K, $Cp(T) = 214.2405 + 3.60151566E\text{-}02T + 6.81264406E\text{-}06T^2$.

HYDROGEN PEROXIDE H_2O_2 300-1500K

$Cp(T) = 827.2894 + 1.66579757T - 6.5656617E\text{-}04T^2 + 4.920427E\text{-}08T^3$

Cp(300) = 1269.27 Cp(800) = 1764.92 Cp(1500) = 2014.78
std error est = 0.6 max error est = 1.5

Note: For T(Cp) calculations, use the above equation and iteratives.

HYDROGEN SULFIDE - Ideal gas H_2S 200-1365K

$Cp(T) = 1001.424 - 0.442935517T + 2.03071482E\text{-}03T^2 - 1.946487E\text{-}06T^3 + 8.5559054E\text{-}10T^4 - 1.51906275E\text{-}13T^5$

Cp(200) = 979.81 Cp(800) = 1250.81 Cp(1365) = 1480.42

std error est = 0.4 max error est = 1.5

HYDROGEN SULFIDE, D_2S 100-1500K

DIDEUTERATED

$Cp(T) = 951.92162 - 0.636298T + 3.834902E\text{-}03T^2 - 5.1606288E\text{-}06T^3 + 3.4347917E\text{-}09T^4 - 1.18396309E\text{-}12T^5 + 1.70442092E\text{-}16T^6$

Cp(100) = 921.81 Cp(800) = 1318.59 Cp(1500) = 1548.24

std error est = 0.7 max error est = 1.5

100-1500K

$T(Cp) = -164765.798 + 671.44529Cp - 1.09343063Cp^2 + 8.8987356E\text{-}04Cp^3 - 3.61561554E\text{-}07Cp^4 + 5.87557715E\text{-}11Cp^5$

T(921.81) = 129 T(1318.59) = 803 T(1548.24) = 1505

std error est = 8.5 max error est = 29.0

HYDROGEN SULFIDE, T_2S 50-250K

DITRITIATED

$Cp(T) = 867.963 + 0.2747135T - 5.06698273E\text{-}03T^2 + 3.5644166E\text{-}05T^3 - 6.07263928E\text{-}08T^4$

Cp(50) = 873.08 Cp(180) = 897.27 Cp(250) = 939.54

std error est = 0.5 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 50-250K, $Cp(T) = 884.648608 - 0.326396624T + 2.20660346E\text{-}03T^2$.

HYDROGEN SULFIDE, HDS 50-1500K

MONODEUTERATED

$Cp(T) = 962.62194 - 0.35271253T + 1.90644836E\text{-}03T^2 - 1.27551132E\text{-}06T^3 - 3.3335115E\text{-}10T^4 + 6.2782923E\text{-}13T^5 - 1.75469178E\text{-}16T^6$

Cp(50) = 949.59 Cp(800) = 1270.71 Cp(1500) = 1499.5

std error est = 1.3 max error est = 2.5

HYDROGEN SULFIDE, MONO- DEUTERATED/MONOTRITIATED DTS 100-250K

$Cp(T) = 930.5966 - 0.671343T + 3.7680173E\text{-}03T^2 - 3.14889788E\text{-}06T^3$

Cp(100) = 897.99 Cp(175) = 911.63 Cp(250) = 949.06

std error est = 0.3 max error est = 1.5

100-250K

$T(Cp) = -1873390.367 + 6052.319684Cp - 6.51827856Cp^2 + 2.3405097E\text{-}03Cp^3$

T(897.99) = 109 T(911.63) = 180 T(949.09) = 257

std error est = 2.4 max error est = 8.5

HYDROGEN SULFIDE, MONO- TRITIATED HTS 50-1500K

$Cp(T) = 947.2175 - 0.6001111T + 3.4256972E\text{-}03T^2 - 4.2387292E\text{-}06T^3 + 2.28571453E\text{-}09T^4 - 4.6662046E\text{-}13T^5$

Cp(50) = 925.26 Cp(800) = 1272.67 Cp(1500) = 1477.19

std error est = 2.2 max error est = 6.5

HYDROXYL OH 0-1500K

$Cp(T) = 1761.23799 - 0.2890543T + 7.1609328E\text{-}04T^2 - 3.6725166E\text{-}07T^3 + 5.9334163E\text{-}11T^4$

Cp(1) = 1760.95 Cp(800) = 1824.56 Cp(1500) = 1999.77

std error est = 3.0 max error est = 5.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 0-1500K, $Cp(T) = 1758.418762 - 0.236699T + 5.4753303E\text{-}04T^2 - 1.89130827E\text{-}07T^3$.

IODINE I_2 250-1500K

$Cp(T) = 131.03309 + 8.1451251E\text{-}02T - 1.4276222E\text{-}04T^2 + 1.088693E\text{-}07T^3 - 2.9318658E\text{-}11T^4$

Cp(250) = 144.06 Cp(900) = 148.83 Cp(1500) = 151.00

std error est = 0.4 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 142.223033 + 1.13334775E\text{-}02T - 3.7835264E\text{-}06T^2$.

IODINE (Monatomic) 55-1550K

Cp(T) = 164.50 - constant

IODINE BROMIDE IBr 250-1500K

$Cp(T) = 160.52687 + 8.1079813E\text{-}02T - 1.175744E\text{-}04T^2 + 7.647269E\text{-}08T^3 - 1.81218914E\text{-}11T^4$

Cp(250) = 174.57 Cp(800) = 181.87 Cp(1500) = 183.96

std error est = 0.5 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 170.84732 + 2.05167565E\text{-}02T - 8.09243496E\text{-}06T^2$.

IODINE CHLORIDE ICl 250-1500K

$Cp(T) = 186.45308 + 0.1656137T - 2.3408245E\text{-}04T^2 + 1.4813037E\text{-}07T^3 - 3.44570338E\text{-}11T^4$

IODINE CHLORIDE (continued)

Cp(250) = 215.41 Cp(800) = 230.86 Cp(1500) = 233.69
std error est = 0.4 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn; 250-1500K, Cp(T) = 207.56253 + 4.364782E-02T - 1.811719E-05T^2.

IODINE FLUORIDE IF 250-1500K

$$Cp(T) = 175.3521 + 0.26519153T - 3.3997426E\text{-}04T^2 + 1.9855293E\text{-}07T^3 - 4.316987E\text{-}11T^4$$

Cp(250) = 223.34 Cp(800) = 253.9 Cp(1500) = 259.77
std error est = 0.4 max error est = 1.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn; 250-1500K, Cp(T) = 188.3318389 + 0.1798053T - 1.5965353E-04T^2 + 4.7953466E-08T^3.

IODINE HEPTAFLUORIDE IF_7 250-1000K

$$Cp(T) = -386.25397 + 6.988192T - 2.19E\text{-}02T^2 + 3.9399594E\text{-}05T^3 - 4.11419754E\text{-}08T^4 + 2.31307177E\text{-}11T^5 - 5.40722595E\text{-}15T^6$$

Cp(250) = 468.22 Cp(600) = 647.34 Cp(1000) = 683.05
std error est = 0.5 max error est = 1.5

IODINE PENTAFLUORIDE IF_5 250-1500K

$$Cp(T) = -58.2197 + 3.228146T - 7.466701E\text{-}03T^2 + 9.66136789E\text{-}06T^3 - 7.133844E\text{-}09T^4 + 2.80488185E\text{-}12T^5 - 4.551596E\text{-}16T^6$$

Cp(250) = 407.87 Cp(800) = 569.99 Cp(1500) = 590.97
std error est = 0.5 max error est = 1.5

IODOMETHANE CH_3I 300-600K

$Cp(T) = 238.1717\exp(0.0011T)$ max error est = 5.0%

ISOPRENE $CH_2C(CH_3)CHCH_2$ 275-1500K

$$Cp(T) = -396.2635 + 8.948094T - 1.0120624E\text{-}02T^2 + 7.068983E\text{-}06T^3 - 2.65012106E\text{-}09T^4 + 3.98613124E\text{-}13T^5$$

Cp(275) = 1431.57 Cp(900) = 3109.24 Cp(1500) = 3723.02
std error est = 1.9 max error est = 4.5

275-1500K

$$T(Cp) = 1061.69 - 1.77172Cp + 1.3189685E\text{-}03Cp^2 - 3.9005614E\text{-}07Cp^3 + 4.618566E\text{-}11Cp^4$$

T(1431.57) = 278 T(3109.24) = 896 T(3723.02) = 1492
std error est = 4.4 max error est = 8.5

KETENE H_2CCO 250-1500K

$Cp(T) = 399.1048 + 2.617846T + 5.971587E\text{-}04T^2 - 5.279979E\text{-}06T^3 + 6.195382E\text{-}09T^4 - 3.1370787E\text{-}12T^5 + 6.0082048E\text{-}16T^6$

Cp(250) = 1029.67 Cp(800) = 1839.39 Cp(1500) = 2235.20

std error est = 1.0 max error est = 2.5

250-1500K

$T(Cp) = 2213.102 - 6.36729113Cp + 7.14666E\text{-}03Cp^2 - 3.3641974E\text{-}06Cp^3 + 6.1602663E\text{-}10Cp^4$

T(1029.67) = 254 T(1839.39) = 796 T(2235.20) = 1494

std error est = 4.0 max error est = 8.5

KRYPTON Kr ALL TEMPERATURES

Cp(T) = 248.05 - constant

MESITYLENE $C_6H_3(CH_3)_3$ 300-1500K

$Cp(T) = 240.097 + 2.177066T + 7.26309147E\text{-}03T^2 - 1.36166E\text{-}05T^3 + 9.1161133E\text{-}09T^4 - 2.1807381E\text{-}12T^5$

Cp(300) = 1247.79 Cp(800) = 2677.81 Cp(1500) = 3481.97

std error est = 1.5 max error est = 2.5

300-1500K

$T(Cp) = 439.7914 - 0.759142Cp + 8.223984E\text{-}04Cp^2 - 2.963892E\text{-}07Cp^3 + 4.24823947E\text{-}11Cp^4$

T(1247.79) = 300 T(2677.81) = 797 T(3481.97) = 1500

std error est = 2.9 max error est = 4.5

METHANE - Ideal gas CH_4 275-755K

$Cp(T) = 1916.5258 - 1.09269T + 8.696605E\text{-}03T^2 - 5.2291144E\text{-}06T^3$

Cp(275) = 2164.97 Cp(500) = 2890.69 Cp(755) = 3799.38

std error est = 0.2 max error est = 1.0

755-1365K

$Cp(T) = 10435.6 - 42.025284T + 8.849006E\text{-}02T^2 - 8.4304566E\text{-}05T^3 + 3.9030203E\text{-}08T^4 - 7.1345169E\text{-}12T^5$

Cp(755) = 3797.77 Cp(1000) = 4491.5 Cp(1365) = 5224.89

std error est = 1.0 max error est = 2.5

275-755K

$T(Cp) = -1405.54 + 1.36736Cp - 3.55452E\text{-}04Cp^2 + 3.823585E\text{-}08Cp^3$

T(2164.97) = 277 T(2890.69) = 500 T(3799.38) = 756

std error est = 0.5 max error est = 2.5

755-1365K

$T(Cp) = -2892.182 + 2.2452Cp - 5.10113E\text{-}04Cp^2 + 4.52369E\text{-}08Cp^3$

T(3797.77) = 755 T(4491.5) = 1000 T(5224.89) = 1365

std error est = 0.4 max error est = 2.5

METHANE - Real gas

METHANE - Real gas (continued) 275-510K

$Cp(T) = -12236.8831 + 262.518875T - 1.9826045T^2 + 7.840392E\text{-}03T^3 - 1.70541464E\text{-}05T^4 + 1.9431809E\text{-}08T^5 - 9.08114724E\text{-}12T^6$

Cp(275) = 2175.89 Cp(375) = 2457.67 Cp(510) = 2912.87

std error est = 2.7 max error est = 6.5

275-510K

$T(Cp) = -742.678 + 0.58853377Cp - 5.46177054E\text{-}05Cp^2$

T(2175.89) = 279 T(2457.67) = 374 T(2912.87) = 508

std error est = 2.8 max error est = 5.5

METHANE, DIDEUTERATED CH_2D_2 95-1275K

$\ln[Cp(T)] = 7.6070340658 - 1.74744883E\text{-}03T + 9.23134494E\text{-}06T^2 - 1.06684914E\text{-}08T^3 + 3.85790574E\text{-}12T^4$

Cp(95) = 1836.3 Cp(675) = 3475.02 Cp(1275) = 4762.75

**Note: Cp(T) = exp[fctn(T)] max error est = 45.0

METHANE, DIDEUTERATED CD_2T_2 95-1275K

DITRITIATED

$Cp(T) = 1858.141 - 6.9817888T + 4.033067E\text{-}02T^2 - 6.835852E\text{-}05T^3 + 5.20572E\text{-}08T^4 - 1.490558E\text{-}11T^5$

Cp(95) = 1504.37 Cp(675) = 3215.76 Cp(1275) = 4180.76

std error est = 3.0 max error est = 6.5

METHANE, DITRITIATED CH_2T_2 95-1275K

$Cp(T) = 1861.969 - 3.8411072T + 1.9495867E\text{-}02T^2 - 2.0658472E\text{-}05T^3 + 7.0155845E\text{-}09T^4$

Cp(95) = 1655.87 Cp(675) = 3254.97 Cp(1275) = 4379.07

std error est = 7.2 max error est = 15.0

METHANE, MONODEUTERATED CH_3D 95-1275K

$\ln[Cp(T)] = 7.685260605 - 1.89630346E\text{-}03T + 8.85273067E\text{-}06T^2 - 9.69191539E\text{-}09T^3 + 3.378275E\text{-}12T^4$

Cp(95) = 1952.7 Cp(675) = 3495.99 Cp(1275) = 4905.71

**Note: Cp(T) = exp[fctn(T)] max error est = 9.5

METHANE, MONODEUTERATED, CDT_3 95-1275K

TRITRITIATED

$Cp(T) = 1792.8646 - 7.153158T + 4.2595806E\text{-}02T^2 - 7.46524585E\text{-}05T^3 + 5.84466516E\text{-}08T^4 - 1.70935846E\text{-}11T^5$

Cp(95) = 1438.36 Cp(675) = 3150.99 Cp(1275) = 4046.87

std error est = 1.2 max error est = 2.5

METHANE, MONOTRITIATED CH_3T 95-1275K

$\ln[Cp(T)] = 7.623967385 - 1.89530858E\text{-}03T + 9.19540139E\text{-}06T^2 - 1.02844644E\text{-}08T^3 + 3.63747258E\text{-}12T^4$

METHANE, MONOTRITIATED (continued)

Cp(95) = 1841.58 Cp(675) = 3382.78 Cp(1275) = 4684.41

**Note: Cp(T) = exp[fctn(T)] max error est = 11.5

METHANE, TETRADEUTERATED CD_4 95-1275K

$\ln[Cp(T)] = 7.6175941054 - 4.03359764E-03T + 2.34289511E-05T^2 - 4.27574857E-08T^3 + 3.43557214E-11T^4 - 1.01858966E-14T^5$

Cp(95) = 1655.58 Cp(675) = 3376.31 Cp(1275) = 4488.86

**Note: Cp(T) = exp[fctn(T)] max error est = 15.0

METHANE, TETRATRITIATED CT_4 95-1275K

$Cp(T) = 1736.415 - 7.3850897T + 4.525255E-02T^2 - 8.1987002E-05T^3 + 6.5925034E-08T^4 - 1.9662464E-11T^5$

Cp(95) = 1378.16 Cp(675) = 3085.25 Cp(1275) = 3918.72

std error est = 2.9 max error est = 9.5

METHANE, TRIDEUTERATED CHD_3 95-1275K

$Cp(T) = 1967.71 - 4.14269394T + 2.0693509E-02T^2 - 2.1823919E-05T^3 + 7.39241354E-09T^4$

Cp(95) = 1742.80 Cp(675) = 3422.62 Cp(1275) = 4627.45

std error est = 8.8 max error est = 15.0

METHANE, TRIDEUTERATED, MONOTRITIATED CD_3T 95-1275K

$Cp(T) = 1909.6275 - 6.445028T + 3.602721E-02T^2 - 5.7366078E-05T^3 + 4.11246853E-08T^4 - 1.11879465E-11T^5$

Cp(95) = 1576.57 Cp(675) = 3300.89 Cp(1275) = 4339.79

std error est = 5.3 max error est = 11.0

METHANE, TRITRITIATED CHT_3 95-1275K

$Cp(T) = 1793.405 - 5.700601T + 3.260151E-02T^2 - 5.1462346E-05T^3 + 3.64062843E-08T^4 - 9.77635312E-12T^5$

Cp(95) = 1504.84 Cp(675) = 3160.29 Cp(1275) = 4127.4

std error est = 3.6 max error est = 6.5

METHANETHIOL CH_3SH 300-1000K

$Cp(T) = 706.9902 + 0.0461346T + 6.2988574E-03T^2 - 1.0655555E-05T^3 + 7.67648136E-09T^4 - 2.11193895E-12T^5$

Cp(300) = 1057.08 Cp(700) = 1659.04 Cp(1000) = 1960.97

std error est = 0.5 max error est = 2.5

300-1000K

$T(Cp) = -689.19 + 1.5805785Cp - 8.9447465E-04Cp^2 + 2.6908387E-07Cp^3$

T(1057.08) = 300 T(1659.04) = 700 T(1960.97) = 1000

std error est = 0.4 max error est = 1.5

METHYL CH_3 300-1000K

$Cp(T) = 1633.77 + 2.1942T$ $T(Cp) = [Cp - 1633.77]/2.1942$

Note: There are only two data points in the reference source. The accuracy of the fit cannot be adequately established.

METHYL ACETATE CH_3COOCH_3 410K

$Cp = 1540$ - constant

Note: There is but a single data point in the reference source.

METHYL ALCOHOL CH_3OH 275-975K

Ideal gas

$Cp(T) = 468.2325 + 5.233369T - 1.468378E\text{-}02T^2 + 3.72060479E\text{-}05T^3 - 4.766607E\text{-}08T^4 + 2.879509E\text{-}11T^5 - 6.5351158E\text{-}15T^6$

$Cp(275) = 1340.57$ $Cp(675) = 2274.68$ $Cp(975) = 2778.64$

std error est = 0.6 max error est = 2.0

275-975K

$T(Cp) = -704.043 + 1.17817452Cp - 4.5448512E\text{-}04Cp^2 + 8.93023618E\text{-}08Cp^3$

$T(1340.57) = 274$ $T(2274.68) = 675$ $T(2778.64) = 977$

std error est = 0.8 max error est = 2.5

METHYLAMINE CH_3NH_2 275-1475K

$Cp(T) = 943.047 + 0.1489865T + 1.356349E\text{-}02T^2 - 2.595927E\text{-}05T^3 + 2.34257414E\text{-}08T^4 - 1.05893911E\text{-}11T^5 + 1.91432176E\text{-}15T^6$

$Cp(275) = 1588.03$ $Cp(875) = 3226.76$ $Cp(1475) = 4031.33$

std error est = 2.0 max error est = 4.5

275-1475K

$T(Cp) = 417.62 - 0.72820643Cp + 6.4038758E\text{-}04Cp^2 - 1.8338439E\text{-}07Cp^3 + 2.11959172E\text{-}11Cp^4$

$T(1588.03) = 277$ $T(3226.76) = 872$ $T(4031.33) = 1473$

std error est = 2.3 max error est = 4.5

2-METHYLBUTANE $(CH_3)_2CHCH_2CH_3$ 300-1500K

$Cp(T) = 153.06 + 4.3328259T + 6.6922173E\text{-}03T^2 - 1.8629145E\text{-}05T^3 + 1.81902873E\text{-}08T^4 - 8.3598691E\text{-}12T^5 + 1.4996865E\text{-}15T^6$

$Cp(300) = 1680.34$ $Cp(800) = 3468.73$ $Cp(1500) = 4524.36$

std error est = 1.6 max error est = 4.0

300-1500K

$T(Cp) = 732.49 - 1.00072568Cp + 6.833615E\text{-}04Cp^2 - 1.725454E\text{-}07Cp^3 + 1.73798873E\text{-}11Cp^4$

$T(1680.34) = 300$ $T(3468.73) = 798$ $T(4524.36) = 1496$

std error est = 3.4 max error est = 7.5

2-METHYL-2-BUTANOL $(CH_3)_2COHCH_2CH_3$ 400-575K

$\ln[Cp(T)] = 722.5726607 - 5.769804449T + 0.012524666T^2 + 1.60592914E-05T^3 - 1.06765564E-07T^4 + 1.57879296E-10T^5 - 7.86807765E-14T^6$

Cp(400) = 2000.65 Cp(500) = 2301.88 Cp(575) = 2736.30

**Note: Cp(T) = exp[fctn(T)] max_error_est = 10.0

3-METHYL-1-BUTANOL $(CH_3)_2CH(CH_2)_2OH$ 450-500K

$Cp(T) = 12449.8133 - 46.47211274T + 5.25188485E-02T^2$

Cp(450) = 2172.43 Cp(475) = 2225.12 Cp(500) = 2343.47

std error est = 1.1 max error est = 4.5

450-500K

$T(Cp) = -6275.55 + 5.7093249Cp - 1.20269088E-03Cp^2$

T(2172.43) = 452 T(2225.12) = 474 T(2343.47) = 499

std error est = 2.4 max_error_est = 6.0

3-METHYL-1-BUTYNE $(CH_3)_2CHCCH$ 300-1500K

$Cp(T) = 17.777 + 6.352748T - 4.78347376E-03T^2 + 1.9843222E-06T^3 - 3.49882302E-10T^4$

Cp(300) = 1543.83 Cp(800) = 2911.21 Cp(1500) = 3709.89

std error est = 2.0 max error est = 4.5

300-1500K

$T(Cp) = 1134.29 - 1.94512287Cp + 1.4522943E-03Cp^2 - 4.2842051E-07Cp^3 + 4.99658252E-11Cp^4$

T(1543.83) = 300 T(2911.21) = 799 T(3709.89) = 1496

std error est = 2.9 max_error_est = 6.5

METHYL CHLORIDE CH_3Cl 255-755K

Ideal gas

$Cp(T) = 332.8997 + 1.6366402T - 3.801244E-05T^2 - 4.04253913E-07T^3$

Cp(275) = 771.69 Cp(500) = 1091.19 Cp(755) = 1372.92

std error est = 0.2 max error est = 2.5

755-1365K

$Cp(T) = 526.238 + 1.16955813T + 2.7488708E-04T^2 - 5.75072686E-07T^3 + 1.67250614E-10T^4$

Cp(755) = 1372.8 Cp(1000) = 1562.86 Cp(1365) = 1752.91

std error est = 0.1 max error est = 1.0

255-755K

$T(Cp) = -458.583 + 1.4667588Cp - 9.82376432E-04Cp^2 + 4.05810172E-07Cp^3$

T(771.69) = 275 T(1091.19) = 499 T(1372.92) = 754

std error est = 0.5 max error est = 1.5

755-1365K

$T(Cp) = -6942.55 + 14.831976Cp - 1.0193339E-02Cp^2 + 2.5303315E-06Cp^3$

T(1372.8) = 755 T(1562.86) = 999 T(1752.91) = 1364

std error est = 0.6 max error est = 1.5

METHYL CYANIDE CH_3CN 290-1200K

$Cp(T) = 1303.384 - 4.942871T + 2.849223E\text{-}02T^2 - 5.4871983E\text{-}05T^3 + 5.3623977E\text{-}08T^4 - 2.63165765E\text{-}11T^5 + 5.11566313E\text{-}15T^6$

Cp(290) = 1256.21 Cp(650) = 1963.81 Cp(1200) = 2567.87

std error est = 1.7 max error est = 4.5

290-1200K

$T(Cp) = -813.42 + 1.58371Cp - 8.002791E\text{-}04Cp^2 + 1.8985947E\text{-}07Cp^3$

T(1256.21) = 290 T(1963.81) = 648 T(2567.87) = 1192

std error est = 4.4 max error est = 9.5

METHYL ETHER $(CH_3)_2O$ 275-1275K

$Cp(T) = 626.107 + 2.175166T + 2.77749E\text{-}03T^2 - 3.7041748E\text{-}06T^3 + 1.1994434E\text{-}09T^4$

Cp(275) = 1364.15 Cp(675) = 2469.63 Cp(1275) = 3406.78

std error est = 7.2 max error est = 15.5

275-1275K

$T(Cp) = -687.49 + 1.161406Cp - 4.4639784E\text{-}04Cp^2 + 8.05362496E\text{-}08Cp^3$

T(1364.15) = 271 T(2469.63) = 671 T(3406.78) = 1273

std error est = 6.3 max error est = 10.5

METHYLHYDRAZINE CH_3NHNH_2 300-1500K

$Cp(T) = -230.3353 + 8.3735806T - 1.038813E\text{-}02T^2 + 8.570289E\text{-}06T^3 - 3.9110406E\text{-}09T^4 + 7.27987797E\text{-}13T^5$

Cp(300) = 1548.29 Cp(800) = 2844.7 Cp(1500) = 3609.98

std error est = 5.1 max error est = 10.5

300-1500K

$T(Cp) = 1646.485 - 2.833585Cp + 2.0125928E\text{-}03Cp^2 - 5.8370013E\text{-}07Cp^3 + 6.66115245E\text{-}11Cp^4$

T(1548.29) = 300 T(2844.7) = 798 T(3609.98) = 1498

std error est = 4.7 max error est = 7.5

METHYLIDYNE CH 300-1000K

$Cp(T) = 2156.83 + 0.2622T$ $T(Cp) = [Cp - 2156.83]/0.2622$

Note: There are only two data points in the reference source. The accuracy of the fit cannot be adequately established.

METHYL ISOCYANIDE CH_3NC 275-755K

$Cp(T) = 357.656 + 6.2401786T - 2.013433E\text{-}02T^2 + 4.623548E\text{-}05T^3 - 5.0729918E\text{-}08T^4 + 2.0834756E\text{-}11T^5$

Cp(275) = 1255.24 Cp(500) = 1704.06 Cp(755) = 2117.84

std error est = 1.7 max error est = 20.0

METHYL ISOCYANIDE (continued) 275-755K

$T(Cp) = -929.29 + 1.6998Cp - 8.2667574E\text{-}04Cp^2 + 1.88543E\text{-}07Cp^3$

T(1255.24) = 275 Cp(1704.06) = 500 Cp(2117.84) = 754

std error est = 0.9 max error est = 3.5

2-METHYLPENTANE $(CH_3)_2CH(CH_2)_2CH_3$ 300-1000K

$Cp(T) = 684.245 - 5.70106E\text{-}03T + 1.9830116E\text{-}02T^2 - 3.690549E\text{-}05T^3 + 2.8436028E\text{-}08T^4 - 8.1932667E\text{-}12T^5$

Cp(300) = 1681.22 Cp(600) = 2896.28 Cp(1000) = 3845.93

std error est = 2.0 max error est = 4.5

300-1000K

$T(Cp) = -220.405 + 0.475071Cp - 1.430724E\text{-}04Cp^2 + 2.652954E\text{-}08Cp^3$

T(1681.22) = 300 T(2896.28) = 600 T(3845.93) = 1000

std error est = 0.6 max error est = 2.5

3-METHYLPENTANE $[CH_3CH_2]_2CH(CH_3)$ 300-1000K

$Cp(T) = 1424.458 - 8.421426T + 6.009702E\text{-}02T^2 - 1.35448706E\text{-}04T^3 + 1.5779472E\text{-}07T^4 - 9.48522387E\text{-}11T^5 + 2.3256203E\text{-}14T^6$

Cp(300) = 1714.25 Cp(600) = 2909.14 Cp(1000) = 3850.03

std error est = 1.4 max error est = 3.5

300-1000K

$T(Cp) = -226.975 + 0.4721466Cp - 1.4127356E\text{-}04Cp^2 + 2.633499E\text{-}08Cp^3$

T(1714.25) = 300 T(2909.14) = 599 T(3850.03) = 1000

std error est = 0.7 max error est = 2.5

4-METHYL-2-PENTANONE $CH_3COCH_2CH(CH_3)_2$ 275-1275K

$Cp(T) = 266.655 + 4.794024T - 2.2291946E\text{-}03T^2 + 3.4395827E\text{-}07T^3$

Cp(275) = 1423.58 Cp(675) = 2592.73 Cp(1275) = 3468.11

std error est = 7.0 max error est = 15.5

275-1275K

$T(Cp) = 892.053 - 1.68075Cp + 1.3909914E\text{-}03Cp^2 - 4.3712435E\text{-}07Cp^3 + 5.3282889E\text{-}11Cp^4$

T(1423.58) = 276 T(2592.73) = 674 T(3468.11) = 1268

std error est = 8.1 max error est = 17.5

2-METHYL-1-PROPANOL $(CH_3)_2CHCH_2OH$ 390-600K

$Cp(T) = 66430.768 - 523.644673T + 1.572952115T^2 - 2.07471664E\text{-}03T^3 + 1.01994038E\text{-}06T^4$

Cp(390) = 1980.96 Cp(500) = 2253.15 Cp(600) = 2552.20

std error est = 8.1 max error est = 15.5

390-600K

$T(Cp) = -585.026 + 0.6296626Cp - 6.49129487E\text{-}05Cp^2$

T(1980.96) = 407 T(2253.15) = 504 T(2552.20) = 599

std error est = 7.9 max error est = 17.5

2-METHYL-2-PROPANOL $(CH_3)_3COH$ 360-590K

$Cp(T) = 1159558.4 - 14251.01382T + 72.825463058T^2 - 0.1978064T^3 + 3.0125819E-04T^4 - 2.4393359E-07T^5 + 8.2046497E-11T^6$

Cp(360) = 2123.03 Cp(450) = 2152.98 Cp(590) = 2625.67

std error est = 3.9 max error est = 10.5

2-METHYLPROPENE $(CH_3)_2CCH_2$ 275-1500K

$Cp(T) = 360.3445 + 3.60460787T + 4.45078E-03T^2 - 1.2087027E-05T^3 + 1.1350898E-08T^4 - 5.08523225E-12T^5 + 8.992065E-16T^6$

Cp(275) = 1494.14 Cp(800) = 3122.69 Cp(1500) = 4078.26

std error est = 1.1 max error est = 8.0

275-1500K

$T(Cp) = 675.5 - 1.08191523Cp + 8.400338E-04Cp^2 - 2.3638415E-07Cp^3 + 2.637218E-11Cp^4$

T(1494.14) = 277 T(3122.69) = 798 T(4078.26) = 1496

std error est = 2.8 max error est = 5.5

METHYL SULFIDE $(CH_3)_2S$ 300-1000K

$Cp(T) = -275.0796 + 10.650717T - 3.669097E-02T^2 + 8.1787615E-05T^3 - 9.94226515E-08T^4 + 6.1455998E-11T^5 - 1.51906388E-14T^6$

Cp(300) = 1159.15 Cp(600) = 1757.63 Cp(1000) = 2314.99

std error est = 0.7 max error est = 2.5

300-1000K

$T(Cp) = -553.78 + 1.1759729Cp - 5.4085555E-04Cp^2 + 1.3944132E-07Cp^3$

T(1159.15) = 300 T(1757.63) = 599 T(2314.99) = 1000

std error est = 1.0 max error est = 2.5

NEON Ne Ideal gas ALL TEMPERATURES

Cp(T) = 1029.91 - constant

NITRIC OXIDE - Ideal gas NO 110-1365K

$Cp(T) = 1188.304 - 1.4425597T + 3.465558E-03T^2 - 2.861451E-06T^3 + 4.0387214E-10T^4 + 6.1972525E-13T^5 - 2.4090578E-16T^6$

Cp(110) = 1067.82 Cp(800) = 1092.5 Cp(1365) = 1179.32

std error est = 0.3 max error est = 2.5

NITRIC OXIDE - Real gas 165-645K

$Cp(T) = 1378.8188 - 3.82241T + 1.7887256E-02T^2 - 5.6028657E-05T^3 + 1.16489E-07T^4 - 1.32980437E-10T^5 + 6.13527678E-14T^6$

Cp(165) = 1054.73 Cp(400) = 997.68 Cp(645) = 1054.39

std error est = 0.3 max error est = 1.5

NITRIC OXIDE - Real gas (continued) 645-1365K

$Cp(T) = 806.451 + 0.506398T - 2.0853977E\text{-}04T^2 + 2.8257004E\text{-}08T^3$

Cp(645) = 1053.90 Cp(1000) = 1132.57 Cp(1365) = 1180.99

std error est = 0.2 max error est = 1.5

645-1365K

$T(Cp) = -152350.55 + 425.34707Cp - 0.39764893Cp^2 + 1.2506075E\text{-}04Cp^3$

T(1053.90) = 645 T(1132.57) = 998 T(1180.99) = 1361

std error est = 2.0 max error est = 4.5

NITROGEN - Ideal gas N_2 255-590K

$Cp(T) = 1088.047 - 0.355968T + 7.2907605E\text{-}04T^2 - 2.8861556E\text{-}07T^3$

Cp(255) = 1039.9 Cp(450) = 1049.2 Cp(590) = 1072.54

std error est = 0.1 max error est = 1.0

590-1365K

$Cp(T) = 1405.5077 - 2.1894566T + 4.7852898E\text{-}03T^2 - 4.540166E\text{-}06T^3 + 2.08491259E\text{-}09T^4 - 3.7903033E\text{-}13T^5$

Cp(590) = 1072.57 Cp(1000) = 1167.06 Cp(1365) = 1227.83

std error est = 0.1 max error est = 1.5

Note: For T(Cp) calculations from 255-590K, use the iterative procedures discussed in Section 5 and the following eqn: 255-590K, $Cp(T) = 1068.513739 - 0.20687009T + 3.63655082E\text{-}04T^2$.

590-1365K

$T(Cp) = -126050.925 + 333.06633Cp - 0.295083212Cp^2 + 8.823403E\text{-}05Cp^3$

T(1072.57) = 592 T(1167.06) = 1000 T(1227.83) = 1365

std error est = 0.8 max error est = 4.5

NITROGEN - Real gas 255-1365K

$Cp(T) = 1058.5365 - 4.391145E\text{-}03T - 7.6852515E\text{-}04T^2 + 2.751091E\text{-}06T^3 - 3.1245817E\text{-}09T^4 + 1.5407594E\text{-}12T^5 - 2.8488096E\text{-}16T^6$

Cp(255) = 1041.43 Cp(800) = 1122.09 Cp(1365) = 1228.69

std error est = 0.2 max error est = 1.0

NITROGEN (Monatomic) N 50-1500K

Cp(T) = 1485.0 - constant

NITROUS OXIDE - Ideal gas N_2O 200-1365K

$Cp(T) = 419.153 + 2.2147124T - 2.922847E\text{-}03T^2 + 2.51402093E\text{-}06T^3 - 1.21894601E\text{-}09T^4 + 2.4536593E\text{-}13T^5$

Cp(200) = 763.42 Cp(800) = 1188.6 Cp(1365) = 1321.25

std error est = 0.2 max error est = 1.5

NITROUS OXIDE (continued) 200-1365K

$T(Cp) = 14575.3 - 61.673304Cp + 9.760584E\text{-}02Cp^2 - 6.8073563E\text{-}05Cp^3 + 1.8008804E\text{-}08Cp^4$

T(763.42) = 207 Cp(1188.6) = 798 Cp(1321.25) = 1349

std error est = 4.5 max error est = 15.5

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n-NONANE - Ideal gas C_9H_{20} 275-755K

$Cp(T) = 234.445 + 5.1354876T - 6.79961E\text{-}04T^2 - 1.0363492E\text{-}06T^3$

Cp(275) = 1573.73 Cp(500) = 2502.65 Cp(755) = 3278.13

std error est = 0.2 max error est = 10

755-1365K

$Cp(T) = 4090.2728 - 12.293253T + 3.122246E\text{-}02T^2 - 3.12285246E\text{-}05T^3 + 1.46875287E\text{-}08T^4 - 2.6962143E\text{-}12T^5$

Cp(755) = 3277.62 Cp(1000) = 3782.27 Cp(1365) = 4273.54

std error est = 0.5 max error est = 1.5

275-755K

$T(Cp) = -224.99 + 0.4584096Cp - 1.27932559E\text{-}04Cp^2 + 2.413833E\text{-}08Cp^3$

T(1573.73) = 274 T(2502.65) = 499 T(3278.13) = 753

std error est = 0.7 max error est = 4.5

755-1365K

$T(Cp) = -5895.99 + 5.3023838Cp - 1.510136E\text{-}03Cp^2 + 1.5605569E\text{-}07Cp^3$

T(3277.62) = 755 T(3782.27) = 999 T(4273.54) = 1364

std error est = 0.6 max error est = 2.5

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n-OCTANE - Ideal gas C_8H_{18} 275-755K

$Cp(T) = 214.4198 + 5.356905T - 1.17497E\text{-}03T^2 - 6.991155E\text{-}07T^3$

Cp(275) = 1584.17 Cp(500) = 2511.74 Cp(755) = 3288.24

std error est = 0.2 max error est = 2.5

755-1365K

$Cp(T) = 2435.9686 - 4.4681947T + 1.6684329E\text{-}02T^2 - 1.7885605E\text{-}05T^3 + 8.6428202E\text{-}09T^4 - 1.614265E\text{-}12T^5$

Cp(755) = 3287.84 Cp(1000) = 3795.05 Cp(1365) = 4289.93

std error est = 0.3 max error est = 2.5

275-755K

$T(Cp) = -200.8856 + 0.42218566Cp - 1.119355E\text{-}04Cp^2 + 2.1840378E\text{-}08Cp^3$

T(1584.17) = 274 T(2511.74) = 499 T(3288.24) = 754

std error est = 0.6 max error est = 3.5

755-1365K

$T(Cp) = -5575.87 + 5.022854Cp - 1.42858E\text{-}03Cp^2 + 1.47978204E\text{-}07Cp^3$

T(3287.84) = 755 T(3795.05) = 999 T(4289.93) = 1364

std error est = 0.7 max error est = 2.5

OXYGEN - Ideal gas O_2 255-590K

$Cp(T) = 929.247 - 0.3220603T + 1.166523E\text{-}03T^2 - 7.1157865E\text{-}07T^3$

Cp(255) = 911.18 Cp(375) = 934.99 Cp(590) = 999.15

OXYGEN - Ideal gas (continued)

std error est = 0.1 max error est = 1.5

590-1365K

$Cp(T) = 597.7293 + 1.183704T - 1.156226E\text{-}03T^2 + 5.82171E\text{-}07T^3 - 1.1772692E\text{-}10T^4$

Cp(590) = 998.93 Cp(1000) = 1089.65 Cp(1365) = 1131.11

std error est = 0.2 max error est = 1.5

255-590K

$T(Cp) = -236734.7 + 726.57886Cp - 0.744909Cp^2 + 2.5566076E\text{-}04Cp^3$

T(911.18) = 258 T(934.99) = 376 T(999.15) = 593

std error est = 0.9 max error est = 3.0

590-1365K

$T(Cp) = -140010.9 + 416.5007Cp - 0.4145086Cp^2 + 1.386105E\text{-}04Cp^3$

T(998.93) = 588 T(1089.65) = 999 T(1131.11) = 1361

std error est = 1.3 max error est = 5.5

OXYGEN - Real gas 255-590K

$Cp(T) = 953.3639 - 0.4638376T + 1.4358763E\text{-}03T^2 - 8.748782E\text{-}07T^3$

Cp(255) = 913.95 Cp(450) = 955.68 Cp(590) = 999.85

std error est = 0.2 max error est = 1.5

590-1365K

$Cp(T) = 219.422 + 3.319747T - 5.8573E\text{-}03T^2 + 5.63507E\text{-}06T^3 - 2.77339408E\text{-}09T^4 + 5.4687139E\text{-}13T^5$

Cp(590) = 999.51 Cp(1000) = 1090.42 Cp(1365) = 1132.44

std error est = 0.3 max error est = 2.5

255-590K

$T(Cp) = -295718.67 + 907.2036Cp - 0.92916735Cp^2 + 3.182752E\text{-}04Cp^3$

T(913.95) = 262 T(955.68) = 452 T(999.85) = 592

std error est = 2.7 max error est = 6.5

590-1365K

$T(Cp) = -132405.2 + 394.1196Cp - 0.392574Cp^2 + 1.3144876E\text{-}04Cp^3$

T(999.51) = 588 T(1090.42) = 1001 T(1132.44) = 1365

std error est = 2.0 max error est = 4.5

OXYGEN (Monatomic) O 100-1500K

$Cp(T) = 1585.2189 - 1.215663T + 2.1959047E\text{-}03T^2 - 1.99642E\text{-}06T^3 + 8.9693573E\text{-}10T^4 - 1.5832808E\text{-}13T^5$

Cp(100) = 1483.70 Cp(800) = 1311.40 Cp(1500) = 1303.03

std error est = 2.2 max error est = 4.5

OXYGEN FLUORIDE OF_2 250-1500K

$Cp(T) = 332.589 + 2.433234T - 3.634798E\text{-}03T^2 + 2.898411E\text{-}06T^3 - 1.1968015E\text{-}09T^4 + 2.0153116E\text{-}13T^5$

Cp(250) = 754.53 Cp(800) = 1012.72 Cp(1500) = 1057.85

std error est = 0.6 max error est = 2.5

OXYGEN FLUORIDE (continued)

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 250-1500K, $Cp(T) = 473.5175767 + 1.433681085T - 1.2241397E-03T^2 + 3.5368257E-07T^3$.

n-PENTANE - Ideal gas C_5H_{12} 275-755K

$Cp(T) = 272.2797 + 4.8751313T - 7.26261E-05T^2 - 1.3441227E-06T^3$

Cp(255) = 1488.43 Cp(500) = 2523.67 Cp(755) = 3333.14

std error est = 0.2 max error est = 1.5

755-1365K

$Cp(T) = 3335.717 - 8.6427T + 2.4429916E-02T^2 - 2.47927E-05T^3 + 1.1664427E-08T^4 - 2.13511208E-12T^5$

Cp(755) = 3332.45 Cp(1000) = 3859.55 Cp(1365) = 4378.1

std error est = 0.4 max error est = 1.5

255-755K

$T(Cp) = -212.8507 + 0.43514236Cp - 1.13646E-04Cp^2 + 2.102165E-08Cp^3$

T(1488.43) = 252 T(2523.67) = 499 T(3333.14) = 754

std error est = 0.6 max error est = 2.5

755-1365K

$T(Cp) = -5111.7 + 4.53933127Cp - 1.2637957E-03Cp^2 + 1.29008845E-07Cp^3$

T(3332.45) = 755 T(3859.55) = 999 T(4378.1) = 1364

std error est = 0.6 max error est = 2.5

n-PENTANE - Real gas 275-610K

$Cp(T) = 568.52265 + 3.2610887T + 2.9780582E-03T^2 - 3.3016552E-06T^3$

Cp(275) = 1621.87 Cp(475) = 2435.62 Cp(610) = 2916.51

std error est = 1.1 max error est = 2.5

275-610K

$T(Cp) = -24.41966 + 0.14680646Cp + 2.40140066E-05Cp^2$

T(1621.87) = 277 T(2435.62) = 476 T(2916.51) = 608

std error est = 1.0 max error est = 2.5

1-PENTANOL $CH_3(CH_2)_4OH$ 420-575K

$\ln[Cp(T)] = 10.279185082 - 1.70935586E-02T + 3.51784187E-05T^2 - 2.23529412E-08T^3$

Cp(420) = 2098.13 Cp(500) = 2280.35 Cp(575) = 2516.24

**Note: Cp(T) = exp[fctn(T)] max error est = 31.5

3-PENTANONE $(C_2H_5)_2CO$ 275-1275K

$Cp(T) = 454.357 + 3.5460727T - 7.37756E-06T^2 - 1.42200623E-06T^3 + 5.2151059E-10T^4$

Cp(275) = 1402.39 Cp(875) = 2904.59 Cp(1275) = 3394.43

std error est = 7.3 max error est = 15.5

3-PENTANONE (continued) 275-1275K

$T(Cp) = 613.076 - 1.234964Cp + 1.14343587E\text{-}03Cp^2 - 3.77839E\text{-}07Cp^3 + 4.8618495E\text{-}11Cp^4$

T(1402.39) = 276 T(2904.59) = 874 T(3394.43) = 1273

std error est = 4.6 max error est = 12.5

1-PENTENE $CH_2CH(CH_2)_2CH_3$ 300-1000K

$Cp(T) = -2907.644 + 35.149484T - 0.12403026T^2 + 2.59522805E\text{-}04T^3 - 3.0126233E\text{-}07T^4 + 1.8150582E\text{-}10T^5 - 4.4468884E\text{-}14T^6$

Cp(300) = 1450.01 Cp(600) = 2583.63 Cp(1000) = 3508.99

std error est = 0.7 max error est = 2.0

300-1000K

$T(Cp) = 687.768 - 1.0899882Cp + 8.813122E\text{-}04Cp^2 - 2.5959466E\text{-}07Cp^3 + 2.9687246E\text{-}11Cp^4$

T(1450.01) = 300 T(2583.63) = 600 T(3508.99) = 999

std error est = 1.1 max error est = 2.5

1-PENTYNE $HCCCH_2CH_2CH_3$ 300-1500K

$Cp(T) = 728.51 + 0.945078T + 1.1769974E\text{-}02T^2 - 2.4194313E\text{-}05T^3 + 2.2017637E\text{-}08T^4 - 9.7690847E\text{-}12T^5 + 1.7071486E\text{-}15T^6$

Cp(300) = 1573.93 Cp(600) = 2480.27 Cp(1500) = 3698.55

std error est = 2.3 max error est = 5.5

300-1500K

$T(Cp) = 1238.15 - 2.163448Cp + 1.6002117E\text{-}03Cp^2 - 4.685943E\text{-}07Cp^3 + 5.38393765E\text{-}11Cp^4$

T(1573.93) = 301 T(2480.27) = 604 T(3698.55) = 1493

std error est = 4.9 max error est = 10.5

2-PENTYNE $CH_3CCCH_2CH_3$ 300-1500K

$Cp(T) = 452.2996 + 2.3209779T + 5.95716E\text{-}03T^2 - 1.31102E\text{-}05T^3 + 1.156122E\text{-}08T^4 - 4.958557E\text{-}12T^5 + 8.4360724E\text{-}16T^6$

Cp(300) = 1412.97 Cp(800) = 2741.04 Cp(1500) = 3574.30

std error est = 2.2 max error est = 4.5

300-1500K

$T(Cp) = 921.43 - 1.691162Cp + 1.3965377E\text{-}03Cp^2 - 4.3702767E\text{-}07Cp^3 + 5.350453E\text{-}11Cp^4$

T(1412.97) = 300 T(2741.04) = 799 T(3574.30) = 1498

std error est = 3.9 max error est = 7.5

PHOSGENE $COCl_2$ 100-1500K

$Cp(T) = 191.11 + 2.065565T - 3.2659378E\text{-}03T^2 + 2.8264054E\text{-}06T^3 - 1.2613311E\text{-}09T^4 + 2.2603022E\text{-}13T^5$

PHOSGENE (continued)

$Cp(100) = 367.71$ $Cp(800) = 757.91$ $Cp(1500) = 811.14$

std error est = 1.8 max error est = 3.5

PHOSPHINE PH_3 100-1500K

$$Cp(T) = 1105.46 - 2.30246882T + 1.2040496E\text{-}02T^2 - 1.9018E\text{-}05T^3 + 1.541445E\text{-}08T^4 - 6.4490826E\text{-}12T^5 + 1.0993473E\text{-}15T^6$$

$Cp(100) = 978.08$ $Cp(800) = 1720.90$ $Cp(1500) = 2142.31$

std error est = 1.3 max error est = 2.5

PHOSPHINE, TRIDEUTERATED PD_3 300-1000K

$$Cp(T) = 577.57 + 1.8502044T + 7.1804343E\text{-}04T^2 - 2.132996E\text{-}06T^3 + 9.1328895E\text{-}10T^4$$

$Cp(300) = 1147.06$ $Cp(700) = 1712.22$ $Cp(1000) = 1926.11$

std error est = 0.4 max error est = 1.5

300-1000K

$$T(Cp) = 4259.23 - 12.773886Cp + 1.4525346E\text{-}02Cp^2 - 7.085359E\text{-}06Cp^3 + 1.3141044E\text{-}09Cp^4$$

$T(1147.06) = 300$ $T(1712.22) = 700$ $T(1926.11) = 1000$

std error est = 0.9 max error est = 3.5

PHOSPHORUS TRICHLORIDE PCl_3 100-1500K

$$Cp(T) = 118.82 + 2.8526816T - 7.620737E\text{-}03T^2 + 1.10669999E\text{-}05T^3 - 8.9651026E\text{-}09T^4 + 3.799535E\text{-}12T^5 - 6.55658E\text{-}16T^6$$

$Cp(100) = 338.09$ $Cp(800) = 591.05$ $Cp(1500) = 600.84$

std error est = 0.6 max error est = 1.5

PHOSPHORUS TRIFLUORIDE PF_3 100-1500K

$$Cp(T) = 250.76 + 1.7158179T - 4.21548E\text{-}04T^2 - 3.5547345E\text{-}06T^3 + 5.2965343E\text{-}09T^4 - 3.00115347E\text{-}12T^5 + 6.166475E\text{-}16T^6$$

$Cp(100) = 415.07$ $Cp(800) = 881.29$ $Cp(1500) = 926.47$

std error est = 1.8 max error est = 4.5

PROPADIENE $C(CH_2)_2$ 275-1500K

$$Cp(T) = 252.095 + 4.5469778T - 4.231012E\text{-}04T^2 - 5.3604454E\text{-}06T^3 + 6.62186899E\text{-}09T^4 - 3.3478109E\text{-}12T^5 + 6.3370948E\text{-}16T^6$$

$Cp(275) = 1391.92$ $Cp(800) = 2655.77$ $Cp(1500) = 3348.20$

std error est = 0.9 max error est = 3.5

275-1500K

$$T(Cp) = 1271.52 - 2.4411838Cp + 1.9691654E\text{-}03Cp^2 - 6.3636372E\text{-}07Cp^3 + 8.1224744E\text{-}11Cp^4$$

$T(1391.92) = 278$ $T(2655.77) = 798$ $T(3348.20) = 1495$

PROPADIENE (continued)

std error est = 3.3 max error est = 7.5

PROPANE - Ideal gas C_3H_8 275-755K

$Cp(T) = 84.1607 + 5.7701407T - 1.292127E\text{-}03T^2 - 6.9945925E\text{-}07T^3$

Cp(275) = 1558.69 Cp(500) = 2558.77 Cp(755) = 3403.05

std error est = 0.2 max error est = 1.5

755-1365K

$Cp(T) = 3474.56 - 9.4956207T + 2.643558E\text{-}02T^2 - 2.6640384E\text{-}05T^3 + 1.2466175E\text{-}08T^4 - 2.271073E\text{-}12T^5$

Cp(755) = 3402.59 Cp(1000) = 3969.24 Cp(1365) = 4529.56

std error est = 0.4 max error est = 1.5

275-755K

$T(Cp) = -134.47 + 0.349Cp - 8.1104732E\text{-}05Cp^2 + 1.623344E\text{-}08Cp^3$

T(1558.69) = 274 T(2558.77) = 499 T(3403.05) = 754

std error est = 0.6 max error est = 2.5

755-1365K

$T(Cp) = -4331.0 + 3.78505Cp - 1.0204888E\text{-}03Cp^2 + 1.02092847E\text{-}07Cp^3$

T(3402.59) = 755 T(3969.24) = 999 T(4529.56) = 1364

std error est = 0.6 max error est = 2.5

CYCLOPROPANE C_3H_8 100-1000K

$Cp(T) = 1304.37 - 9.76052T + 5.6216148E\text{-}02T^2 - 9.9085315E\text{-}05T^3 + 7.8256763E\text{-}08T^4 - 2.34147557E\text{-}11T^5$

Cp(100) = 798.99 Cp(600) = 2604.79 Cp(1000) = 3516.69

std error est = 3.3 max error est = 8.5

1,2-PROPANEDIOL $CH_3CHOHCH_2OH$ 275-775K

$Cp(T) = 840.077 + 1.432479T + 7.47762E\text{-}03T^2 - 1.398118E\text{-}05T^3 + 7.503585E\text{-}09T^4$

Cp(275) = 1551.65 Cp(525) = 2200.05 Cp(775) = 2640.29

std error est = 3.4 max error est = 7.5

275-775K

$T(Cp) = -170.21 + 0.384686Cp - 1.377934E\text{-}04Cp^2 + 4.859613E\text{-}08Cp^3$

T(1551.65) = 276 T(2200.05) = 527 T(2640.29) = 779

std error est = 2.1 max error est = 6.5

1-PROPANOL $CH_3(CH_2)_2OH$ 275-1500K

$Cp(T) = -18.073 + 4.897967T + 4.1591909E\text{-}03T^2 - 1.714072E\text{-}05T^3 + 1.9134617E\text{-}08T^4 - 9.587348E\text{-}12T^5 + 1.8328355E\text{-}15T^6$

Cp(275) = 1382.08 Cp(800) = 2962.56 Cp(1500) = 3779.34

std error est = 2.2 max error est = 4.5

275-1500K

$T(Cp) = 805.72 - 1.316275Cp + 1.03367336E\text{-}03Cp^2 - 3.1066055E\text{-}07Cp^3 + 3.7595022E\text{-}11Cp^4$

1-PROPANOL (continued)

T(1382.08) = 278 T(2962.56) = 797 T(3779.34) = 1495
std error est = 4.0 max error est = 9.5

2-PROPANOL $(CH_3)_2CHOH$ 275-1500K

$$Cp(T) = 281.08 + 3.55930603T + 5.60782535E\text{-}03T^2 - 1.592439E\text{-}05T^3 + 1.567946E\text{-}08T^4 - 7.2127354E\text{-}12T^5 + 1.289756E\text{-}15T^6$$

Cp(275) = 1431.69 Cp(800) = 2961.18 Cp(1500) = 3789.51
std error est = 2.5 max error est = 6.5

275-1500K

$$T(Cp) = 712.46 - 1.195778Cp + 9.704307E\text{-}04Cp^2 - 2.9394792E\text{-}07Cp^3 + 3.576185E\text{-}11Cp^4$$

T(1431.69) = 277 T(2961.18) = 798 T(3789.51) = 1495
std error est = 3.3 max error est = 6.5

PROPYLBENZENE $C_6H_5(CH_2)_2CH_3$ 300-1500K

$$Cp(T) = 156.805 + 2.42815T + 9.353183E\text{-}03T^2 - 2.149015E\text{-}05T^3 + 1.9780312E\text{-}08T^4 - 8.6963805E\text{-}12T^5 + 1.499592E\text{-}15T^6$$

Cp(300) = 1286.98 Cp(800) = 2727.9 Cp(1500) = 3495.42
std error est = 1.8 max error est = 4.0

300-1500K

$$T(Cp) = 788.38 - 1.415034Cp + 1.254462E\text{-}03Cp^2 - 4.2097165E\text{-}07Cp^3 + 5.5624451E\text{-}11Cp^4$$

T(1286.98) = 300 T(2727.9) = 798 T(3495.42) = 1494
std error est = 3.9 max error est = 7.5

PROPYL ETHER $[CH_3(CH_2)_2]_2O$ 275-1275K

$$Cp(T) = 2220.965 - 15.85878T + 8.362134E\text{-}02T^2 - 1.752393E\text{-}04T^3 + 1.89973E\text{-}07T^4 - 1.0442973E\text{-}10T^5 + 2.2914465E\text{-}14T^6$$

Cp(275) = 1471.38 Cp(775) = 2885.54 Cp(1275) = 3333.43
std error est = 9.0 max error est = 21.5

PROPYNE CH_3CCH 275-1500K

$$Cp(T) = 296.204 + 5.18992T - 4.4112215E\text{-}03T^2 + 2.621706E\text{-}06T^3 - 9.5357975E\text{-}10T^4 + 1.5122198E\text{-}13T^5$$

Cp(275) = 1439.14 Cp(800) = 2626.24 Cp(1500) = 3324.94
std error est = 0.7 max error est = 3.5

275-1500K

$$T(Cp) = 1475.3 - 2.85557Cp + 2.245565E\text{-}03Cp^2 - 7.110777E\text{-}07Cp^3 + 8.859352E\text{-}11Cp^4$$

T(1439.14) = 277 T(2626.24) = 798 T(3324.94) = 1496
std error est = 2.7 max error est = 7.5

SILANE SiH_4 100-1500K

$Cp(T) = 1250.39 - 4.4063697T + 0.02678T^2 - 4.8775018E\text{-}05T^3 + 4.4327926E\text{-}08T^4 - 2.0245577E\text{-}11T^5 + 3.687426E\text{-}15T^6$

Cp(100) = 1033.1 Cp(800) = 2390.97 Cp(1500) = 2952.51

std error est = 5.8 max error est = 20.5

SILICON TETRACHLORIDE $SiCl_4$ 100-1500K

$Cp(T) = 112.78 + 2.865988T - 7.278228E\text{-}03T^2 + 1.0156921E\text{-}05T^3 - 7.960333E\text{-}09T^4 + 3.27887075E\text{-}12T^5 - 5.517042E\text{-}16T^6$

Cp(100) = 335.99 Cp(800) = 617.09 Cp(1500) = 630.84

std error est = 1.0 max error est = 2.5

SILICON TETRAFLUORIDE SiF_4 100-1500K

$Cp(T) = 142.66 + 3.045967T - 5.205945E\text{-}03T^2 + 5.425593E\text{-}06T^3 - 3.534804E\text{-}09T^4 + 1.32511825E\text{-}12T^5 - 2.1643323E\text{-}16T^6$

Cp(100) = 400.28 Cp(800) = 955.15 Cp(1500) = 1011.97

std error est = 0.7 max error est = 1.5

STYRENE $C_6H_5CHCH_2$ 275-1500K

$Cp(T) = -126.7 + 4.27917184T + 2.927387E\text{-}03T^2 - 1.2277425E\text{-}05T^3 + 1.2935809E\text{-}08T^4 - 6.1243779E\text{-}12T^5 + 1.11436976E\text{-}15T^6$

Cp(275) = 1080,96 Cp(800) = 2467.92 Cp(1500) = 3116.28

std error est = 1.1 max error est = 2.5

275-1500K

$T(Cp) = 913.36 - 1.888481Cp + 1.8311187E\text{-}03Cp^2 - 6.899175E\text{-}07Cp^3 + 1.01386298E\text{-}10Cp^4$

T(1080.96) = 279 T(2467.92) = 796 T(3116.28) = 1493

std error est = 4.5 max error est = 10.5

SULFUR S_2 275-1500K

$Cp(T) = 376.86 + 0.6300876T - 7.88127E\text{-}04T^2 + 4.5750016E\text{-}07T^3 - 1.0076704E\text{-}10T^4$

Cp(275) = 499.46 Cp(800) = 569.24 Cp(1500) = 580.95

std error est = 0.5 max error est = 2.5

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 275-1500K, $Cp(T) = 409.44875 + 0.421901486T - 3.57102338E\text{-}04T^2 + 1.02449694E\text{-}07T^3$.

SULFUR (Monatomic) S 100-1500K

$Cp(T) = 504.485 + 2.3393178T - 8.5202771E\text{-}03T^2 + 1.43794546E\text{-}05T^3 - 1.26931826E\text{-}08T^4 + 5.67465485E\text{-}12T^5 - 1.0136105E\text{-}15T^6$

Cp(100) = 666.38 Cp(800) = 679.87 Cp(1500) = 660.51

std error est = 1.2 max error est = 3.0

SULFUR DICHLORIDE SCl_2 100-1500K

$Cp(T) = 239.65 + 1.59183756T - 3.52713E\text{-}03T^2 + 4.2688109E\text{-}06T^3 - 2.9106702E\text{-}09T^4 + 1.0505776E\text{-}12T^5 - 1.5627007E\text{-}16T^6$

Cp(100) = 367.55 Cp(800) = 552.47 Cp(1500) = 561.14

std error est = 0.9 max error est = 2.5

SULFUR DIFLUORIDE SF_2 100-1500K

$Cp(T) = 446.1812 - 0.070297366T + 4.760524E\text{-}03T^2 - 1.189425E\text{-}05T^3 + 1.2720916E\text{-}08T^4 - 6.4083936E\text{-}12T^5 + 1.2442913E\text{-}15T^6$

Cp(100) = 476.07 Cp(800) = 783.59 Cp(1500) = 817.97

std error est = 3.5 max error est = 8.0

SULFUR DIOXIDE SO_2 300-1365K

Ideal gas

$Cp(T) = 432.805 + 0.5994156T + 4.593367E\text{-}04T^2 - 1.433024E\text{-}06T^3 + 1.0409341E\text{-}09T^4 - 2.5313735E\text{-}13T^5$

Cp(300) = 623.09 Cp(700) = 793.33 Cp(1365) = 876.40

std error est = 0.3 max error est = 1.5

300-1365K

$T(Cp) = 155222.71 - 877.595265Cp + 1.857197245Cp^2 - 1.7428909E\text{-}03Cp^3 + 6.1359879E\text{-}07Cp^4$

T(623.09) = 309 T(793.33) = 696 T(876.40) = 1342

std error est = 5.5 max error est = 23.5

SULFUR HEXAFLUORIDE SF_6 100-1500K

$Cp(T) = 24.233 + 2.33532T + 1.4344428E\text{-}03T^2 - 1.05440664E\text{-}05T^3 + 1.3847595E\text{-}08T^4 - 7.6376433E\text{-}12T^5 + 1.56118585E\text{-}15T^6$

Cp(100) = 262.88 Cp(800) = 990.5 Cp(1500) = 1056.46

std error est = 5.7 max error est = 11.5

SULFUR MONOCHLORIDE S_2Cl_2 100-1500K

$Cp(T) = 150.63 + 2.756806T - 7.3955367E\text{-}03T^2 + 1.07461656E\text{-}05T^3 - 8.69281614E\text{-}09T^4 + 3.6742817E\text{-}12T^5 - 6.31809797E\text{-}16T^6$

Cp(100) = 362.27 Cp(800) = 602.75 Cp(1500) = 611.68

std error est = 0.9 max error est = 2.5

SULFUR MONOXIDE SO 300-1500K

$Cp(T) = 498.98 + 0.54531131T - 3.97417036E\text{-}04T^2 + 1.0243734E\text{-}07T^3$

Cp(300) = 629.57 Cp(900) = 742.53 Cp(1500) = 768.48

std error est = 0.7 max error est = 2.0

300-1500K

$T(Cp) = 2673548.1 - 15732.3334Cp + 34.6862568Cp^2 - 3.3963896E\text{-}02Cp^3 + 1.24657038E\text{-}05Cp^4$

T(629.57) = 301 T(742.53) = 902 T(768.48) = 1513

SULFUR MONOXIDE (continued)

std error est = 2.5 max error est = 15.5

SULFUR TETRAFLUORIDE SF_4 100-1500K

$$\ln[Cp(T)] = 5.4481069265 + 5.31628197E\text{-}03T - 7.63297357E\text{-}06T^2 + 4.87033913E\text{-}09T^3 - 1.14651855E\text{-}12T^4$$

Cp(200) = 514.49 Cp(800) = 934.52 Cp(1500) = 974.07

**Note: Cp(T) = exp[fctn(T)] max error est = 15.5

SULFUR TRIOXIDE SO_3 100-1500K

$$Cp(T) = 332.45 + 0.76715644T + 2.18883267E\text{-}03T^2 - 6.4464146E\text{-}06T^3 + 6.8053136E\text{-}09T^4 - 3.3274957E\text{-}12T^5 + 6.2860794E\text{-}16T^6$$

Cp(100) = 425.26 Cp(800) = 908.35 Cp(1500) = 995.38

std error est = 1.4 max error est = 3.5

SULFURYL FLUORIDE SO_2F_2 100-1500K

$$Cp(T) = 188.38 + 1.51815532T + 1.6848848E\text{-}03T^2 - 8.08750268E\text{-}06T^3 + 9.88024136E\text{-}09T^4 - 5.25778454E\text{-}12T^5 + 1.0506054E\text{-}15T^6$$

Cp(100) = 349.89 Cp(800) = 939.92 Cp(1500) = 1020.75

std error est = 3.2 max error est = 7.5

THIONYL CHLORIDE $SOCl_2$ 100-1500K

$$Cp(T) = 126.39 + 3.01522T - 8.0321113E\text{-}03T^2 + 1.2067313E\text{-}05T^3 - 1.01854131E\text{-}08T^4 + 4.48266475E\text{-}12T^5 - 7.98302653E\text{-}16T^6$$

Cp(100) = 358.68 Cp(800) = 664.14 Cp(1500) = 687.57

std error est = 1.4 max error est = 3.5

THIONYL FLUORIDE SOF_2 100-1500K

$$Cp(T) = 252.57 + 1.591359T + 9.12985723E\text{-}05T^2 - 4.47083245E\text{-}06T^3 + 6.1962479E\text{-}09T^4 - 3.45812419E\text{-}12T^5 + 7.09108083E\text{-}16T^6$$

Cp(100) = 408.73 Cp(800) = 885.74 Cp(1500) = 941.53

std error est = 2.3 max error est = 5.5

THIOPHOSGENE $CSCl_2$ 275-1000K

$$Cp(T) = 59.14 + 3.3998836T - 8.5876389E\text{-}03T^2 + 1.1794626E\text{-}05T^3 - 8.30715093E\text{-}09T^4 + 2.33820883E\text{-}12T^5$$

Cp(275) = 546.13 Cp(600) = 660.37 Cp(1000) = 697.07

std error est = 0.7 max error est = 2.5

275-1000K

$$T(Cp) = 488250.36 - 3272.97043Cp + 8.22103684Cp^2 - 9.17008593E\text{-}03Cp^3 + 3.83549875E\text{-}06Cp^4$$

T(546.13) = 277 T(660.37) = 589 T(697.07) = 989

std error est = 9.4 max error est = 21.5

TOLUENE C_7H_8 275-755K

Ideal gas

$Cp(T) = -310.29 + 5.640685T - 2.81410224E\text{-}03T^2 + 2.4913887E\text{-}07T^3$

Cp(275) = 1033.26 Cp(500) = 1837.67 Cp(755) = 2451.54

std error est = 0.2 max error est = 2.0

755-1365K

$Cp(T) = 109.89 + 4.64889983T - 2.404749E\text{-}03T^2 + 4.70371704E\text{-}07T^3$

Cp(755) = 2451.48 Cp(1000) = 2824.41 Cp(1365) = 3171.35

std error est = 0.2 max error est = 2.0

275-755K

$T(Cp) = -62.5 + 0.441587267Cp - 1.62355359E\text{-}04Cp^2 + 4.8116433E\text{-}08Cp^3$

T(1033.26) = 274 T(1837.67) = 499 T(2451.54) = 753

std error est = 0.7 max error est = 3.0

755-1365K

$T(Cp) = -6732.5 + 8.1967182Cp - 3.1808569E\text{-}03Cp^2 + 4.4184319E\text{-}07Cp^3$

T(2451.48) = 755 T(2824.41) = 999 T(3171.35) = 1364

std error est = 0.9 max error est = 2.5

TOLUENE - Real gas 300-610K

$Cp(T) = 8.203797 + 4.000876T + 1.11409614E\text{-}04T^2 - 1.5192015E\text{-}06T^3$

Cp(300) = 1177.48 Cp(450) = 1692.72 Cp(610) = 2145.36

std error est = 1.2 max error est = 3.0

300-610K

$T(Cp) = -91.3 + 0.44221698Cp - 1.4179088E\text{-}04Cp^2 + 4.099999E\text{-}08Cp^3$

T(1177.48) = 300 T(1692.72) = 450 T(2145.36) = 610

std error est = 0.6 max error est = 2.5

1,1,1-TRICHLOROETHANE CH_3CCl_3 300-600K

$Cp(T) = 558.306\exp(0.0011T)$

Cp(300) = 776.59 Cp(450) = 915.9 Cp(600) = 1080.21

**Note: The accuracy of this fit is within 5.0% of the reference source values. The estimated maximum error is 45.

TRICHLOROFLUORO- CCl_3F 90-700K (FREON-11)

METHANE - Ideal gas

$Cp(T) = 88.42 + 2.6878447T - 4.66910945E\text{-}03T^2 + 3.96538806E\text{-}06T^3 - 1.311654E\text{-}09T^4$

Cp(90) = 295.31 Cp(450) = 660.02 Cp(700) = 727.25

std error est = 0.3 max error est = 2.5

700-1365K

$Cp(T) = 398.846 + 0.85444834T - 6.7934387E\text{-}04T^2 + 1.8385308E\text{-}07T^3$

Cp(700) = 727.14 Cp(1000) = 757.8 Cp(1365) = 766.99

std error est = 0.2 max error est = 2.5

TRICHLOROFLUOROMETHANE (FREON-11) (continued)

90-700K

$T(Cp) = 1858.9 - 17.09586Cp + 5.92007E\text{-}02Cp^2 - 8.71182475E\text{-}05Cp^3 + 4.813565E\text{-}08Cp^4$

T(295.31) = 96 T(660.02) = 451 T(727.25) = 693

std error est = 3.8 max error est = 9.5

Note: For T(Cp) calculations from 700-1365K, use the iterative procedures discussed in Section 5 and the following equations: 700-1365K, $Cp(T) = 573.5800054 + 0.306189477T - 1.21913823E\text{-}04T^2$.

TRICHLOROTRIFLUORO-ETHANE (FREON-113) $C_2Cl_3F_3$ 320-465K

$Cp(T) = 953.33 - 4.1752099T + 1.48443126E\text{-}02T^2 - 1.4511695E\text{-}05T^3$

Cp(320) = 661.80 Cp(425) = 746.12 Cp(465) = 762.5

std error est = 0.1 max error est = 1.5

320-465K

$T(Cp) = -39428.5 + 169.22394Cp - 0.2413860737Cp^2 + 1.1549402E\text{-}04Cp^3$

T(661.80) = 318 T(746.12) = 426 T(762.5) = 462

std error est = 1.7 max error est = 4.5

TRICHLOROSILANE $SiHCl_3$ 100-1000K

$Cp(T) = 163.34 + 2.096026T - 3.3286844E\text{-}03T^2 + 2.57996254E\text{-}06T^3 - 7.76498622E\text{-}10T^4$

Cp(100) = 342.16 Cp(600) = 679.27 Cp(1000) = 734.15

std error est = 1.5 max error est = 3.5

100-1000K

$T(Cp) = 9037.45 - 76.410239Cp + 0.238723665Cp^2 - 3.24312525E\text{-}04Cp^3 + 1.64234225E\text{-}07Cp^4$

T(342.16) = 101 T(679.27) = 602 T(734.15) = 990

std error est = 8.9 max error est = 15.5

1,1,1-TRICHLORO-2,2,2-TRI-FLUOROETHANE CF_3CCl_3 200-800K

$Cp(T) = 185.89 + 1.4044747T + 2.6500078E\text{-}03T^2 - 1.18943003E\text{-}05T^3 + 1.45980328E\text{-}08T^4 - 6.1337978E\text{-}12T^5$

Cp(200) = 499.02 Cp(500) = 784.54 Cp(800) = 885.02

std error est = 0.7 max error est = 2.0

200-800K

$T(Cp) = 7781.2 - 49.265363Cp + 0.117538654Cp^2 - 1.2291743E\text{-}04Cp^3 + 4.8509877E\text{-}08Cp^4$

T(499.02) = 200 T(784.54) = 498 T(885.02) = 798

std error est = 4.3 max error est = 9.5

1,1,1-TRIFLUOROETHANE CH_3CF_3 100-1500K

1,1,1-TRIFLUOROETHANE (continued)

$Cp(T) = 264.398 + 1.8040847T + 4.17525467E\text{-}03T^2 - 1.2539045E\text{-}05T^3 + 1.3278592E\text{-}08T^4 - 6.49158273E\text{-}12T^5 + 1.2220205E\text{-}15T^6$

Cp(100) = 475.28 Cp(800) = 1591.93 Cp(1500) = 1892.56

std error est = 1.7 max error est = 3.5

TRIFLUOROIODOMETHANE CF_3I 100-1000K

$CpT) = 103.14 + 1.255612T - 1.56065E\text{-}03T^2 + 9.460232E\text{-}07T^3 - 2.27049635E\text{-}10T^4$

Cp(100) = 214.02 Cp(600) = 469.59 Cp(1000) = 517.08

std error est = 0.4 max error est = 2.0

Note: For T(Cp) calculations, use the iterative procedures discussed in Section 5 and the following eqn: 100-1000K, $Cp(T) = 110.51576796 + 1.161867871T - 1.20896094E\text{-}03T^2 + 4.5474783E\text{-}07T^3$.

TRIMETHYLAMINE $(CH_3)_3N$ 275-1475K

$Cp(T) = 773.274 - 1.34861408T + 2.365832E\text{-}02T^2 - 4.5452006E\text{-}05T^3 + 4.1145841E\text{-}08T^4 - 1.84648686E\text{-}11T^5 + 3.29518026E\text{-}15T^6$

Cp(275) = 1454.01 Cp(875) = 3384.35 Cp(1475) = 4173.36

std error est = 2.1 max error est = 5.5

275-1475K

$T(Cp) = 430.45 - 0.63430825Cp + 5.6407771E\text{-}04Cp^2 - 1.6640782E\text{-}07Cp^3 + 1.9643825E\text{-}11Cp^4$

T(1454.01) = 277 T(3384.35) = 871 T(4173.36) = 1471

std error est = 3.4 max error est = 7.5

2,3,4-TRIMETHYL-PENTANE $[(CH_3)_2CH]_2CHCH_3$ 400-520K

$Cp(T) = 686.88 + 3.789T$ $T(Cp) = [Cp - 686.88]/3.789$

There are only three data points in the reference source. The accuracy of this fit cannot be adequately established.

WATER - Ideal gas H_2O 275-1365K

$Cp(T) = 1997.22 - 1.5513626T + 5.4600474E\text{-}03T^2 - 7.4448866E\text{-}06T^3 + 5.92340976E\text{-}09T^4 - 2.54654038E\text{-}12T^5 + 4.50326153E\text{-}16T^6$

Cp(275) = 1858.75 Cp(800) = 2148.61 Cp(1365) = 2527.54

std error est = 0.6 max error est = 3.5

275-1365K

$T(Cp) = -138783.1 + 243.21339Cp - 0.1601304Cp^2 + 4.6992596E\text{-}05Cp^3 - 5.155188E\text{-}09Cp^4$

T(1858.75) = 292 T(2148.61) = 798 T(2527.54) = 1360

std error est = 5.0 max error est = 18.5

WATER - Real gas 375-545K

$Cp(T) = -9151.27 + 124.55666T - 0.43018315T^2 + 2.5078185E\text{-}04T^3 + 1.51700823E\text{-}06T^4 - 3.1440734E\text{-}09T^5 + 1.82314019E\text{-}12T^6$

Cp(375) = 2041.49 Cp(500) = 1976.29 Cp(545) = 1990.98
std error est = 0.5 max error est = 2.5

535-1365K

$Cp(T) = 1855.87 - 0.12328108T + 8.33819257E\text{-}04T^2 - 2.7862857E\text{-}07T^3$

Cp(535) = 1985.91 Cp(1000) = 2287.78 Cp(1365) = 2532.55
std error est = 0.2 max error est = 1.5

Note: For T(Cp) calculations between 375-545K, use the iterative procedures discussed in Section and the following eqn: 375-545K, $Cp(T) = 7288.57944 - 31.60499289T + 6.19666037E\text{-}02T^2 - 4.001532E\text{-}05T^3$.

535-1365K

$T(Cp) = -20093.67 + 24.866517Cp - 1.0260634E\text{-}02Cp^2 + 1.495574E\text{-}06Cp^3$

T(1985.91) = 536 T(2287.78) = 1000 T(2532.55) = 1365
std error est = 0.7 max error est = 3.5

WATER, DIDEUTERATED D_2O 0-1500K

$Cp(T) = 1692.39 + 0.531928T + 9.981787E\text{-}04T^2 - 1.32271877E\text{-}06T^3 + 6.3221224E\text{-}10T^4 - 1.140281E\text{-}13T^5$

Cp(1) = 1692.92 Cp(750) = 2267.77 Cp(1500) = 2606.68
std error est = 1.5 max error est = 3.5

0-1500K

$T(Cp) = -262435.28 + 620.045026Cp - 0.58727707Cp^2 + 2.7838713E\text{-}04Cp^3 - 6.59628036E\text{-}08Cp^4 + 6.2551268E\text{-}12Cp^5$

T(1692.92) = 0 T(2267.77) = 753 T(2606.68) = 1499
std error est = 1.2 max error est = 5.5

XENON - Ideal gas Xe ALL TEMPERATURES

Cp(T) = 158.416 = constant

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m-XYLENE $C_6H_4(CH_3)_2$ 300-1500K

$Cp(T) = 112.448 + 2.48622T + 8.20559E\text{-}03T^2 - 1.897328E\text{-}05T^3 + 1.749458E\text{-}08T^4 - 7.7581914E\text{-}12T^5 + 1.35754047E\text{-}15T^6$

Cp(300) = 1208.38 Cp(800) = 2618.13 Cp(1500) = 3385.32
std error est = 1.4 max error est = 3.5

300-1500K

$T(Cp) = 793.3 - 1.4795435Cp + 1.3653586E\text{-}03Cp^2 - 4.736549E\text{-}07Cp^3 + 6.4258022E\text{-}11Cp^4$

T(1208.38) = 300 T(2618.13) = 798 T(3385.32) = 1495
std error est = 3.8 max error est = 8.5

---

o-XYLENE $C_6H_4(CH_3)_2$ 300-1500K

$Cp(T) = 220.54 + 2.315837T + 8.00889E\text{-}03T^2 - 1.8267628E\text{-}05T^3 + 1.67967527E\text{-}08T^4 - 7.4499897E\text{-}12T^5 + 1.30510608E\text{-}15T^6$

Cp(300) = 1261.77 Cp(800) = 2626.74 Cp(1500) = 3387.23

std error est = 1.0 max error est = 3.5

300-1500K

$T(Cp) = 884.7 - 1.6751046Cp + 1.49528125E\text{-}03Cp^2 - 5.09322185E\text{-}07Cp^3 + 6.778076E\text{-}11Cp^4$

T(1261.77) = 300 T(2626.74) = 798 T(3387.23) = 1495

std error est = 3.7 max error est = 8.5

p-XYLENE $C_6H_4(CH_3)_2$ 300-1500K

$Cp(T) = 240.04 + 1.4903657T + 1.0968075E\text{-}02T^2 - 2.28936254E\text{-}05T^3 + 2.05420776E\text{-}08T^4 - 8.9907546E\text{-}12T^5 + 1.56029453E\text{-}15T^6$

Cp(300) = 1201.83 Cp(800) = 2607.33 Cp(1500) = 3381.23

std error est = 0.9 max error est = 3.5

300-1500K

$T(Cp) = -1458.07 + 4.050261Cp - 3.859663E\text{-}03Cp^2 + 1.9113335E\text{-}06Cp^3 - 4.63203445E\text{-}10Cp^4 + 4.53602623E\text{-}14Cp^5$

T(1201.83) = 300 T(2607.33) = 801 T(3381.23) = 1499

std error est = 1.5 max error est = 4.5

APPENDIX B
TABLE B-I
SUMMARY OF CONTENTS

THERMAL CONDUCTIVITY FOR
GASEOUS ELEMENTS AND COMPOUNDS

TABLE B-I
(CONT.)

NAME	FORMULA	APP B PAGE
Krypton	Kr	B-10
Methane	CH_4	B-10
Methyl Alcohol	CH_3OH	B-10
Methyl Chloride	CH_3Cl	B-10
Neon	Ne	B-11
Nitric Oxide	NO	B-11
Nitrogen	N_2	B-11
Nitrogen Peroxide	NO_2	B-12
Nitrous Oxide	N_2O	B-12
n-Nonane	C_9H_{20}	B-12
n-Octane	C_8H_{18}	B-13
Oxygen	O_2	B-13
n-Pentane	C_5H_{12}	B-13
Propane	C_3H_8	B-13
Radon	Rn	B-14
Sulfur Dioxide	SO_2	B-14
Toluene	C_7H_8	B-14
Trichlorofluoromethane (FREON-11)	CCl_3F	B-14
Trichlorotrifluoroethane (FREON-113)	$C_2Cl_3F_3$	B-15
Water (steam)	H_2O	B-15
Xenon	Xe	B-15

APPENDIX B
FORMAT EXAMPLE

The equations presented are for gaseous Acetylene

The polynomial equation to calculate the thermal conductivity (k) in W/m K as a function of temperature (Kelvin)

Using the polynomial presented, the calculated thermal conductivity at 650K is 0.0619 W/m K.

Over the temperature range noted, the maximum error est is ±7E-04 W/m K.

	Formula	Valid temperature range
-ACETYLENE	C_2H_2	200-650K

$$k(T) = -8.5510082E\text{-}02 + 1.461749E\text{-}03T - 9.4040526E\text{-}06T^2 + 3.242075E\text{-}08T^3 - 5.91795705E\text{-}11T^4 + 5.4937859E\text{-}14T^5 - 2.04661826E\text{-}17T^6$$

k(200) = 0.0116 k(450) = 0.0394 k(650) = 0.0619

std error est = 6.3E-05 max error est = 7E-04

200-650K

$$T(k) = 58.2453 + 13908.7532k - 151692.6999k^2 + 1329757.4619k^3$$

T(0.0116) = 201 T(0.0394) = 452 T(0.0619) = 653

std error est = 1.7 max error est = 3.5

standard (or average) error estimate is ±1.7 degrees Kelvin

Using the polynomial presented, the calculated temperature for a given thermal conductivity of 0.0619 W/m K is 653K.

The polynomial equation to calculate temperature (Kelvin) as a function of thermal conductivity in W/m K

FIGURE B-1

APPENDIX B

THERMAL CONDUCTIVITY FOR GASEOUS ELEMENTS AND COMPOUNDS

ACETONE C_3H_6O 280-500K

$k(T) = -4.11573122E-04 + 4.79793901E-06T + 1.15976849E-07T^2$

k(280) = 0.01002 k(400) = 0.02006 k(500) = 0.03098

std error est = 1.8E-05 max error est = 4.0E-05

280-500K

$T(k) = 136.464 + 15795.28787k - 132356.15338k^2$

T(0.01002) = 281 T(0.02006) = 400 T(0.03098) = 499

std error est = 0.7 max error est = 2.5

ACETYLENE C_2H_2 200-650K

$k(T) = -8.5510082E-02 + 1.461749E-03T - 9.4040526E-06T^2 + 3.242075E-08T^3 - 5.91795705E-11T^4 + 5.4937859E-14T^5 - 2.04661826E-17T^6$

k(200) = 0.0116 k(450) =.0394 k(650) = 0.0619

std error est = 6.3E-05 max error est = 7E-04

200-650K

$T(k) = 58.2453 + 13908.7532k - 151692.6999k^2 + 1329757.4619k^3$

T(0.0116) = 201 T(0.0394) = 452 T(0.0619) = 653

std error est = 1.7 max error est = 3.5

AIR 100-1500K

$k(T) = - 2.276501E-03 + 1.2598485E-04T - 1.4815235E-07T^2 + 1.73550646E-10T^3 - 1.066657E-13T^4 + 2.47663035E-17T^5$

k(100) = 9.0E-02 k(800) = 0.0570 k(1500) = 0.0872

std error est = 1.2E-04 max error est = 2.5E-04

100-1500K

$T(k) = -21.25887 + 12111.0665k - 2060.85234k^2 + 726814.383446k^3$

T(.009) = 88 T(.0570) = 797 T(.0872) = 1501

std error est = 5.0 max error est = 13.5

AMMONIA NH_3 250-900K

$k(T) = 3.25332857E-02 - 2.56604839E-04T + 1.19984154E-06T^2 - 1.8411802E-09T^3 + 1.450888E-12T^4 - 4.5463777E-16T^5$

k(250) = 0.0198 k(650) = 0.0733 k(900) = 0.1147

std error est = 8.8E-05 max error est = 2E-04

250-900K

$T(k) = 59.78 + 10975.1917k - 54118.9276k^2 + 195945.59072k^3$

T(.0198) = 257 T(.0733) = 651 T(.1147) = 902

std error est = 2.1 max error est = 4.5

ARGON Ar 100-2000K

$k(T) = -5.2839462E-04 + 7.60706705E-05T - 6.4749393E-08T^2 + 5.41874502E-11T^3 - 3.22024235E-14T^4 + 1.17962552E-17T^5 - 1.86231745E-21T^6$

k(100) = 6.48E-03 k(800) = 0.03682 k(2000) = 0.06921
std error est = 4.6E-05 max error est = 1E-04

2000-6000K

$k(T) = 1.93082997E-02 + 2.51961654E-05T - 1.67510345E-10T^2 + 1.34423776E-14T^3$

k(2000) = 0.06914 k(4000) = 0.11827 k(6000) = 0.16736
std error est = 6.2E-05 max error est = 1E-04

6000-10000K

$k(T) = 9.646322815 - 8.33091359E-03T + 2.95984109E-06T^2 - 5.46353403E-10T^3 + 5.53001474E-14T^4 - 2.90734681E-18T^5 + 6.22212377E-23T^6$

k(6000) = 0.16724 k(8000) = 0.2483 k(10000) = 0.4559
std error est = 2.9E-04 max error est = 4E-04

100-2000K

$T(k) = 6.817 + 13959.6435k + 48739.9133k^2 + 6473513.547817k^3 - 59362842.0531k^4$

T(6.48E-03) = 101 T(0.03682) = 801 T(0.06921) = 1990
std error est = 2.5 max error est = 11

2000-6000K

$T(k) = -806.5 + 40519.97783k + 982.79608093k^2$

T(0.06914) = 2000 T(0.11827) = 4000 T(0.16736) = 6002
std error est = 2.6 max error est = 5.0

BENZENE C_6H_6 250-600K

$k(T) = 1.26398664E-02 - 8.09524147E-05T + 2.45397874E-07T^2$

k(250) = 7.74E-03 k(450) = 0.0259 k(600) = 0.05241
std error est = 5E-05 max error est = 1E-04

250-600K

$T(k) = 119.7 + 20654.901668k - 382444.26277k^2 + 3143235.5389k^3$

T(7.74E-03) = 258 T(0.0259) = 453 T(0.05241) = 604
std error est = 2.9 max error est = 8.5

BORON TRIFLUORIDE BF_3 250-400K

$k(T) = -0.013508927 + 1.74995767E-04T - 2.88441695E-07T^2 + 2.22936681E-10T^4$

k(250) = 0.0157 k(350) = 0.02196 k(400) = 0.02461
std error est = 3.3E-05 max error est = 1E-04

250-400K

$T(k) = 118.06 + 3008.28162k + 343663.276584k^2$

T(0.0157) = 250 T(0.02196) = 350 T(0.02461) = 400
std error est = 0.6 max error est = 1.5

BROMINE Br_2 250-350K

$k(T) = 1.836200284 - 3.09326519E-02T + 2.07612343E-04T^2 - 6.93057809E-07T^3 + 1.15148285E-09T^4 - 7.61810378E-13T^5$

k(250) = 3.8E-03 k(300) = 4.76E-03 k(350) = 5.7E-03

std error est = 2.1E-05 max error est = 1E-04

Note: The pressure dependence between 250-330K has been ignored.

250-350K

$T(k) = 63.28 + 45883.69957k + 808725.8551494k^2$

T(3.8E-03) = 249 T(4.76E-03) = 300 T(5.7E-03) = 351

std error est = 1.6 max error est = 2.5

iso-BUTANE $i\text{-}C_4H_{10}$ 270-500K

$k(T) = 7.7275075E-02 - 8.28249983E-04T + 3.48331547E-06T^2 - 5.71799839E-09T^3 + 3.50919304E-12T^4$

k(270) = 0.01368 k(400) = 0.02719 k(500) = 0.03855

std error est = 3.7E-05 max error est = 1E-04

270-500K

$T(k) = 95.54 + 15411.2231k - 219575.79653k^2 + 2403201.4742k^3$

T(0.01368) = 271 T(0.02719) = 401 T(0.03855) = 501

std error est = 0.8 max error est = 2.5

n-BUTANE $n\text{-}C_4H_{10}$ 280-500K

$k(T) = 3.79912E-03 - 3.38011396E-05T + 3.15886537E-07T^2 - 2.25600514E-10T^3$

k(280) = 0.01415 k(400) = 0.02638 k(500) = 0.03767

std error est = 2.5E-05 max error est = 1E-04

280-500K

$T(k) = 128.42 + 11389.32096k - 41250.42160187k^2$

T(0.01415) = 281 T(0.02638) = 400 T(0.03767) = 499

std error est = 0.7 max error est = 2.0

CARBON DIOXIDE CO_2 200-600K

$k(T) = 2.971488E-03 - 1.33471677E-05T + 3.14443715E-07T^2 - 4.75106178E-10T^3 + 2.68500151E-13T^4$

k(200) = 9.51E-03 k(400) = 0.02441 k(600) = 0.04034

std error est = 2.2E-05 max error est = 1E-04

600-1000K

$k(T) = 6.085375E-02 - 3.63680275E-04T + 1.0134366E-06T^2 - 9.7042356E-10T^3 + 3.27864115E-13T^4$

k(600) = 0.04036 k(800) = 0.05595 k(1000) = 0.06805

std error est = 5.6E-05 max error est = 1.2E-04

CARBON DIOXIDE (continued) 1000-1500K

$k(T) = -4.880854E-02 + 2.05275039E-04T - 1.15912553E-07T^3 + 2.74425613E-11T^3$

k(1000) = 0.0680 k(1250) = 0.08027 k(1500) = 0.09092

std error est = 4.9E-05 max error est = 1E-04

200-600K

$T(k) = 71.53 + 14079.598772k - 24697.758498k^2$

T(9.51E-03) = 203 T(0.02441) = 400 T(0.04034) = 599

std error est = 1.1 max error est = 3.5

600-1000K

$T(k) = 389.988 - 335.1830848k + 137340.8296339k^2$

T(0.04036) = 600 T(0.05595) = 801 T(0.06805) = 1003

std error est = 1.3 max error est = 3.5

1000-1500K

$T(k) = 438.195 - 2034.64765848k + 151207.6747921k^2$

T(0.0680) = 999 T(0.08027) = 1249 T(0.09092) = 1503

std error est = 1.4 max error est = 2.5

CARBON MONOXIDE CO 100-1250K

$k(T) = - 7.41704398E-04 + 9.87435265E-05T - 3.77511167E-08T^2 - 1.99334224E-11T^3 + 3.65528437E-14T^4 - 1.2427179E-17T^5$

k(100) = 8.74E-03 k(650) = 0.0471 k(1250) = 0.07608

std error est = 4E-05 max error est = 1E-04

100-1250K

$T(k) = 12.162 + 8989.653527k + 97279.93110207k^2$

T(8.74E-03) = 98 T(0.0471) = 651 T(0.07608) = 1259

std error est = 3.7 max error est = 11.0

CARBON TETRACHLORIDE CCl_4 250-500K

$k(T) = 7.8364705E-03 - 7.3966726E-05T + 3.78688851E-07T^2 - 5.67675082E-10T^3 + 2.88855251E-13T^4$

k(250) = 5.27E-03 k(400) = 9.9E-03 k(500) = 0.01262

std error est = 1.1E-05 max error est = 1E-04

250-500K

$T(k) = 108.29 + 25202.5901427k + 442601.9142055k^2$

T(5.27E-03) = 253 T(9.9E-03) = 401 T(0.01262) = 497

std error est = 1.7 max error est = 5.5

CHLORINE Cl_2 240-700K

$k(T) = - 5.6373517E-03 + 7.42811048E-05T - 1.39215986E-07T^2 + 2.1640488E-10T^3 - 1.2881365E-13T^4$

k(240) = 6.74E-03 k(450) = 0.01404 k(700) = 0.02144

std error est = 4.7E-05 max error est = 1E-04

CHLORINE (continued) 240-700K

$T(k) = 172.043 - 13603.49935k + 5088112.16192k^2 - 265967414.84k^3 + 5207768348.464k^4$

T(6.74E-03) = 240 T(0.01404) = 450 T(0.02144) = 698

std error est = 1.7 max error est = 5.5

CHLORODIFLUOROMETHANE $CHClF_2$ 250-500K
(FREON-22)

$k(T) = - 4.0615383E-04 + 1.80841025E-05T + 6.18803419E-08T^2$

k(250) = 7.98E-03 k(400) = 0.01673 k(500) = 0.02411

std error est = 2.4E-05 max error est = 1E-04

250-500K

$T(k) = 85.013 + 22663.6699172k - 228007.2338189k^2$

T(7.98E-03) = 251 T(0.01673) = 400 T(0.02411) = 500

std error est = 0.9 max error est = 2.5

CHLOROFORM $CHCl_3$ 340-550K

$k(T) = - 5.860675E-03 + 5.20017788E-05T - 3.8366916E-08T^2 + 3.64052602E-11T^3$

k(340) = 8.82E-03 k(400) = 0.01113 k(550) = 0.01719

std error est = 2.5E-05 max error est = 1E-04

340-550K

$T(k) = 93.34 + 29378.466083k - 162781.2342915k^2$

T(8.82E-03) = 340 T(0.01113) = 400 T(0.01719) = 550

std error est = 0.7 max error est = 1.5

CHLOROTRIFLUOROMETHANE $CClF_3$ 250-500K
(FREON-13)

$k(T) = - 5.6286355E-03 + 5.68433027E-05T + 8.34249085E-09T^2$

k(250) = 9.1E-03 k(400) = 0.01844 k(500) = 0.02488

std error est = 1.8E-05 max error est = 1E-04

250-500K

$T(k) = 98.24 + 16976.00664908k - 33295.38946655k^2$

T(9.1E-03) = 250 T(0.01844) = 400 T(0.02488) = 500

std error est = 0.3 max error est = 1.5

n-DECANE $C_{10}H_{22}$ 250-500K

$k(T) = - 5.88274E-03 + 3.72449646E-05T + 7.55109624E-08T^2$

k(250) = 8.15E-03 k(400) = 0.0211 k(500) = 0.03162

std error est = 2.5E-05 max error est = 1E-04

Note: Pressure dependence between 250-440K ignored.

Note: For T(k) calculations, use the iterative procedures discussed in Section 5 and the polynomial presented above.

DEUTERIUM D_2 25-400K

$k(T) = - 5.698206E-03 + 8.4468815E-04T - 3.02792058E-06T^2 + 1.1004468E-08T^3 - 2.1022893E-11T^4 + 1.58585846E-14T^5$

DEUTERIUM (continued)

k(25) = 0.01369 k(250) = 0.12154 k(400) = 0.1762

std error est = 2.2E-04 max error est =4E-04

25-400K

$T(k) = 0.5886 + 1513.21300425k + 4346.0399915k^2$

T(0.01369) = 22 T(0.12154) = 249 T(0.1762) = 402

std error est = 1.5 max error est = 2.5

DICHLORODIFLUOROMETHANE CCl_2F_2 250-500K

(FREON-12)

$k(T) = -3.233077E-03 + 3.50076218E-05T + 2.7686436E-08T^2 - 2.30654304E-12T^3$

k(250) = 7.21E-03 k(400) = 0.01505 k(500) = 0.0209

std error est = 2.6E-05 max error est = 1E-04

250-500K

$T(k) = 95.995 + 22495.971645k - 152316.4895525k^2$

T(7.21E-03) = 250 T(0.01505) = 400 T(0.0209) = 500

std error est = 0.5 max error est = 1.5

DICHLOROFLUOROMETHANE $CHCl_2F$ 250-450K

(FREON-21)

$k(T) = -3.70498999E-03 + 5.72092142E-05T - 1.13430816E-07T^2 + 1.98784186E-10T^3$

k(250) = 6.61E-03 k(350) = 0.01095 k(450) = 0.01718

std error est = 3.9E-05 max error est = 1E-04

250-450K

$T(k) = 52.34 + 34343.090676k - 655593.6727497k^2$

T(6.61E-03) = 251 T(0.01095) = 350 T(0.01718) = 449

std error est = 0.9 max error est = 2.0

DICHLOROTETRAFLUOROETHANE $C_2Cl_2F_4$ 250-500K

(FREON-114)

$k(T) = 1.5549359E-02 - 7.41226495E-05T + 1.96794871E-07T^2$

k(250) = 9.32E-03 k(400) = 0.01739 k(500) = 0.02769

std error est = 2.6E-05 max error est = 1E-04

250-500K

$T(k) = -127.377 + 58481.31774k - 2155849.717k^2 + 31248863.5628k^3$

T(9.32E-03) = 256 T(0.01739) = 402 T(0.02769) = 502

std error est = 2.5 max error est = 6.5

ETHANE C_2H_6 200-1000K

$k(T) = -3.83815197E-02 + 5.47282126E-04T - 2.80760648E-06T^2 + 8.74854603E-09T^3 - 1.369896E-11T^4 + 1.05765043E-14T^5 - 3.16347435E-18T^6$

k(200) = 0.01002 k(600) = 0.06838 k(1000) = 0.16391

std error est = 1.9E-04 max error est = 3E-04

200-1000K

$T(k) = 128.505 + 8110.832388k - 17342.93335k^2$

T(0.01002) = 208 T(0.06838) = 602 T(0.16391) = 992

ETHYL ALCOHOL C_2H_5OH 250-500K

$k(T) = - 2.46663E-02 + 1.5589255E-04T - 8.22954822E-08T^2$

k(250) = 9.17E-03 k(400) = 0.02453 k(500) = 0.03271

std error est = 2.8E-05 max error est = 1E-04

Note: Pressure dependence between 250-350K ignored.

250-500K

$T(k) = 183.774 + 6437.651482775k + 97730.4282729k^2$

T(9.17E-03) = 251 T(0.02453) = 400 T(0.03271) = 499

std error est = 0.7 max error est = 2.0

ETHYL ETHER $C_4H_{10}O$ 250-500K

$k(T) = - 7.0819597E-04 + 1.855898E-05T + 1.14117826E-07T^2$

k(250) = 0.01106 k(400) = 0.02497 k(500) = 0.0371

std error est = 1.8E-05 max error est = 1E-04

Note: Pressure dependence between 250-300K ignored.

250-500K

$T(k) = 106.1 + 14272.722424k - 99605.2245926k^2$

T(0.01106) = 252 T(0.02497) = 400 T(0.0371) = 499

std error est = 0.9 max error est = 2.5

ETHYLENE C_2H_4 200-450K

$k(T) = 0.1690142 - 2.71392927E-03T + 1.71636899E-05T^2 - 5.16435832E-08T^3 + 7.74044499E-11T^4 - 4.59993653E-14T^5$

k(200) = 8.75E-03 k(350) = 0.02743 k(450) = 0.04262

std error est = 7.0E-05 max error est = 1.2E-04

200-450K

$T(k) = 108.663 + 12177.1554k - 168879.6154k^2 + 1672295.794854k^3$

T(8.75E-03) = 203 T(0.02743) = 350 T(0.04262) = 450

std error est = 1.3 max error est = 3.5

FLUORINE F_2 90-800K

$k(T) = 3.3854087E-04 + 8.27103562E-05T + 5.27622468E-08T^2 - 7.51472474E-11T^3$

k(90) = 8.16E-03 k(400) = 0.03706 k(800) = 0.0618

std error est = 5.9E-05 max error est = 1E-04

Note: For T(k) calculations, use the iterative procedures discussed in Section 5 and the polynomial presented above.

HELIUM He 25-300K

$k(T) = 1.028793E-02 + 8.51625139E-04T - 3.14258034E-06T^2 + 1.02188556E-08T^3 - 1.3477236E-11T^4$

k(25) = 0.02977 k(200) = 0.1151 k(300) = 0.14969

std error est = 1.2E-04 max error est = 2E-04

HELIUM (continued) 300-500K

$k(T) = - 7.761491E-03 + 8.66192033E-04T - 1.5559338E-06T^2 + 1.40150565E-09T^3$

k(300) = 0.1499 k(400) = 0.17946 k(500) = 0.21154

std error est = 1.1E-04 max error est = 2E-04

500-1500K

$k(T) = - 9.0656E-02 + 9.37593087E-04T - 9.13347535E-07T^2 + 5.55037072E-10T^3 - 1.26457196E-13T^4$

k(500) = 0.21128 k(1000) = 0.3622 k(1500) = 0.4938

std error est = 8.9E-04 max error est = 1.3E-03

1500-5000K

$k(T) = 5.26198E-02 + 3.31365073E-04T - 2.81816958E-08T^2 + 2.1409764E-12T^3$

k(1500) = 0.4935 k(3250) = 0.9054 k(5000) = 1.2725

std error est = 2E-03 max error est = 3E-03

100-5000K

$T(k) = -99.57 + 2433.072575k + 1810.239628k^2 - 448.9582131k^3$

T(0.1151) = 204 T(0.4938) = 1489 T(1.2725) = 5003

std error est = 6.5 max error est = 15.0

n-HEPTANE C_7H_{16} 250-1000K

$k(T) = - 4.606147E-02 + 5.95652224E-04T - 2.98893153E-06T^2 + 8.44612876E-09T^3 - 1.2292738E-11T^4 + 9.01270236E-15T^5 - 2.62961437E-18T^6$

k(250) = 0.0082 k(500) = 0.0326 k(1000) = 0.0971

std error est = 1.2E-04 max error est = 4E-04

Note: Pressure dependence between 250-370K ignored.

250-1000K

$T(k) = 156.21 + 12828.33732k - 81042.0901k^2 + 390630.82849k^3$

T(8.2E-03) = 256 T(0.0326) = 502 T(0.0971) = 995

std error est = 2.9 max error est = 9.0

n-HEXANE C_6H_{14} 250-1000K

$k(T) = 1.287757E-03 - 2.00499443E-05T + 2.37858831E-07T^2 - 1.60944555E-10T^3 + 7.71027297E-14T^4$

k(250) = 8.9E-03 k(600) = 0.0501 k(1000) = 0.1353

std error est = 2.9E-04 max error est = 6E-04

250-1000K

$T(k) = 162.609 + 11501.7075k - 63679.79437k^2 + 182669.90973k^3$

T(8.9E-03) = 260 T(0.0501) = 602 T(0.1353) = 1006

std error est = 3.5 max error est = 11.0

HYDROGEN H_2 100-500K

$k(T) = 2.009705E-02 + 3.234622E-04T + 2.1637249E-06T^2 - 6.49151204E-09T^3 + 5.52407932E-12T^4$

k(100) = 0.0681 k(300) = 0.1813 k(500) = 0.2566

HYDROGEN (continued)

std error est = 3.4E-04 max error est = 6E-04

500-1500K

$k(T) = 0.1083105 + 2.21163789E-04T + 2.26380948E-07T^2 - 1.74258636E-10T^3 + 4.6468625E-14T^4$

k(500) = 0.2566 k(1000) = 0.4281 k(1500) = 0.5965

std error est = 3.5E-04 max error est = 7E-04

1500-2000K

$k(T) = -0.28107269 + 1.09703479E-03T - 5.27318283E-07T^2 + 1.2403865E-10T^3$

k(1500) = 0.5966 k(1750) = 0.6886 k(2000) = 0.7960

std error est = 3.7E-04 max error est = 6E-04

100-500K

$T(k) = -18.63 + 1990.8944k - 4723.849445k^2 + 19136.37907k^3$

T(0.0681) = 101 T(0.1813) = 301 T(0.2566) = 505

std error est = 1.8 max error est = 5.5

500-1500K

$T(k) = -228.573 + 2791.61736k + 187.56000746k^2$

T(0.2566) = 500 T(0.4281) = 1001 T(0.5965) = 1503

std error est = 1.4 max error est = 5.0

1500-2000K

$T(k) = -930.817 + 5242.1851374k - 1959.321732k^2$

T(0.5966) = 1499 T(0.6886) = 1750 T(0.796) = 2001

std error est = 1.0 max error est = 3.0

HYDROGEN CHLORIDE HCl 200-700K

$k(T) = 1.2288265E-04 + 3.20474254E-05T + 1.02223086E-07T^2 - 1.99696412E-10T^3 + 1.16463692E-13T^4$

k(200) = 9.2E-03 k(400) = 0.0195 k(700) = 0.0321

std error est = 2.8E-05 max error est = 1E-04

200-700K

$T(k) = 61.98 + 13391.474616k + 203362.8049798k^2$

T(9.2E-03) = 202 T(0.0195) = 400 T(0.0321) = 701

std error est = 1.2 max error est = 2.5

HYDROGEN IODIDE HI 250-1000K

$k(T) = -4.35678828E-04 + 2.3083046E-05T - 3.77024198E-09T^2 + 1.18389384E-12T^3$

k(250) = 5.1E-03 k(600) = 0.0123 k(1000) = 0.0201

std error est = 2.7E-05 max error est = 1E-04

250-1000K

$T(k) = 11.898 + 45338.55831k + 197725.8013557k^2$

T(5.1E-03) = 248 T(0.0123) = 599 T(0.0201) = 1003

std error est = 1.4 max error est = 3.5

HYDROGEN SULFIDE H_2S 220-400K

$k(T) = -5.2404334E-03 + 6.7759251E-05T - 4.05425325E-09T^2$

k(220) = 0.0095 k(300) = 0.0147 k(400) = 0.0212

std error est = 2.9E-05 max error est = 1E-04

220-400K

$T(k) = 77.82 + 14874.853457k + 14686.9999k^2$

T(9.5E-03) = 220 T(0.0147) = 300 T(0.0212) = 400

std error est = 0.5 max error est = 2.0

KRYPTON Kr 120-700K

$k(T) = 4.6142E-05 + 3.48571058E-05T - 1.20386082E-08T^2$

k(120) = 4.06E-03 k(400) = 0.01206 k(700) = 0.01855

std error est = 1.7E-05 max error est = 1E-04

120-700K

$T(k) = 21.254 + 22220.36563k + 761572.7864265k^2$

T(4.06E-03) = 124 T(0.01206) = 400 T(0.01855) = 696

std error est = 1.8 max error est = 4.5

METHANE CH_4 100-1000K

$k(T) = -1.3401499E-02 + 3.6630706E-04T - 1.82248608E-06T^2 + 5.93987998E-09T^3 - 9.1405505E-12T^4 + 6.7896889E-15T^5 - 1.95048736E-18T^6$

k(100) = 0.0101 k(500) = 0.067 k(1000) = 0.169

std error est = 3E-04 max error est = 6E-04

100-1000K

$T(k) = -19.358 + 11993.5848k - 98202.38989k^2 + 631750.65118k^3 - 1542230.678766k^4$

T(0.0101) = 92 T(0.067) = 502 T(0.169) = 994

std error est = 2.8 max error est = 6.5

METHYL ALCOHOL CH_3OH 300-550K

$k(T) = -2.0298675E-02 + 1.21910927E-04T - 2.23748473E-08T^2$

k(300) = 0.0143 k(425) = 0.0275 k(550) = 0.040

std error est = 3.8E-05 max error est = 1E-04

300-550K

$T(k) = 173.252 + 8599.676374k + 20535.0012k^2$

T(0.0143) = 300 T(0.0275) = 425 T(0.040) = 550

std error est = 0.4 max error est = 1.5

METHYL CHLORIDE CH_3Cl 250-750K

$k(T) = -2.8950296E-03 + 2.42340563E-05T + 6.9670016E-08T^2$

k(250) = 7.5E-03 k(400) = 0.0179 k(750) = 0.0545

std error est = 1.1E-04 max error est = 2.5E-04

NEON Ne 50-500K

$k(T) = 2.201564E-03 + 2.27517163E-04T - 2.9729466E-07T^2 + 2.08844136E-10T^3$

k(50) = 0.0129 k(250) = 0.0438 k(500) = 0.0677

std error est = 3.4E-05 max error est = 1E-04

500-1000K

$k(T) = -0.0223377 + 2.83448846E-04T - 2.57636449E-07T^2 + 1.01142695E-10T^3$

k(500) = 0.0676 k(750) = 0.088 k(1000) = 0.1046

std error est = 1.4E-04 max error est = 2E-04

1000-5000K

$k(T) = 0.013526582 + 1.21904517E-04T - 4.05606888E-08T^2 + 1.14406524E-11T^3 - 1.65850704E-15T^4 + 9.29114306E-20T^5$

k(1000) = 0.1047 k(2500) = 0.1878 k(5000) = 0.2929

std error est = 2.9E-04 max error est = 4E-04

50-500K

$T(k) = 12.8374 + 2245.3161k + 73055.0207k^2$

T(0.0129) = 54 T(0.0438) = 251 T(0.0677) = 500

std error est = 1.4 max error est = 4

500-1000K

$T(k) = 1971.304 - 65338.30244k + 844869.0777k^2 - 2954030.585k^3$

T(0.0676) = 503 T(0.088) = 751 T(0.1046) = 1000

std error est = 2.0 max error est = 5.5

1000-5000K

$T(k) = -305.725 + 9215.50632k + 30228.47906k^2$

T(0.1047) = 991 T(0.1878) = 2491 T(0.2929) = 4987

std error est = 9.0 max error est = 14.5

NITRIC OXIDE NO 130-1000K

$k(T) = 2.695164E-03 + 3.8477785E-05T + 3.79042336E-07T^2 - 1.3449086E-09T^3 + 2.15784789E-12T^4 - 1.64052333E-15T^5 + 4.79750187E-19T^6$

k(130) = 0.0117 k(600) = 0.0462 k(1000) = 0.0724

std error est = 4.5E-05 max error est = 1E-04

130-1000K

$T(k) = 20.91 + 7794.64895k + 140783.3849k^2 - 857527.26795k^3$

T(0.0117) = 130 T(0.0462) = 597 T(0.0724) = 998

std error est = 2.1 max error est = 4.5

NITROGEN N_2 100-1500K

$k(T) = -1.5231785E-03 + 1.18879965E-04T - 1.2092845E-07T^2 + 1.15567802E-10T^3 - 6.36537349E-14T^4 + 1.47167023E-17T^5$

k(100) = 9.26E-03 k(500) = 0.03861 k(1500) = 0.0842

std error est = 5.2E-05 max error est = 2E-04

NITROGEN (continued) 1500-3500K

$k(T) = 0.7282944 - 1.54313282E\text{-}03T + 1.3535933E\text{-}06T^2 - 5.5158517E\text{-}10T^3 + 1.08449625E\text{-}13T^4 - 8.26807569E\text{-}18T^5$

k(1500) = 0.08382 k(2500) = 0.14079 k(3500) = 0.19131
std error est = 3.2E-04 max error est = 4E-04

100-1500K

$T(k) = 38.19 + 5560.90414k + 186184.03159k^2 - 521677.344982k^3$

T(9.26E-03) = 105 T(0.03861) = 500 T(0.0842) = 1515
std error est = 3.5 max error est = 15.0

1500-3500K

$T(k) = -15930.55 + 638350.15799k - 9332889.30298k^2 + 67699225.76k^3 - 237257633.7266k^4 + 322622404.826k^5$

T(0.08382) = 1497 T(0.14079) = 25[illegible] T(0.19131) = 3497
std error est = 5.5 max error est = 12.5

NITROGEN PEROXIDE NO_2 440-640K

$k(T) = 8.90074818 - 8.02940254E\text{-}02T + 2.89756384E\text{-}04T^2 - 5.2147063E\text{-}07T^3 + 4.6839284E\text{-}10T^4 - 1.6796286E\text{-}13T^5$

k(440) = 0.03309 k(540) = 0.03752 k(640) = 0.04479
std error est = 4.1E-05 max error est = 2E-04

440-640K

$T(k) = -550.995 + 42497.74266k - 357393.73223k^2$

T(0.03309) = 464 T(0.03752) = 540 T(0.04479) = 635
std error est = 7.5 max error est = 15.0

NITROUS OXIDE N_2O 190-1000K

$k(T) = 6.9918875E\text{-}03 - 7.16238986E\text{-}05T + 6.16971397E\text{-}07T^2 - 1.13449444E\text{-}09T^3 + 9.64569615E\text{-}13T^4 - 3.11996398E\text{-}16T^5$

k(200) = 9.71E-03 k(600) = 0.04182 k(1000) = 0.07042
std error est = 6.8E-05 max error est = 1.2E-04

190-1000K

$T(k) = 89.979 + 11746.9788k + 2979.32622k^2 + 193154.99479k^3$

T(9.71E-03) = 204 T(0.04182) = 601 T(0.07042) = 999
std error est = 2.3 max error est = 5.5

---

n-NONANE C_9H_{20} 250-1000K

$k(T) = -0.01073559242 + 7.71447107E\text{-}05T + 1.70209517E\text{-}10T^2$

k(250) = 8.56E-03 k(600) = 0.03561 k(1000) = 0.06658
std error est = 3.0E-05 max error est = 1E-04

250-1000K

$T(k) = 139.123 + 12954.464853k - 366.184555k^2$

T(8.56E-03) = 250 T(0.03561) = 600 T(0.06658) = 1000
std error est = 0.4 max error est = 1.5

---

n-OCTANE C_8H_{18} 250-500K

$k(T) = -4.0139194E-03 + 3.38796092E-05T + 8.19291819E-08T^2$

k(250) = 9.58E-03 k(400) = 0.02265 k(500) = 0.03341

std error est = 2.9E-05 max error est = 1E-04

Note: Pressure dependence between 250-390K ignored.

250-500K

$T(k) = 121.451 + 14436.05859k - 93780.6879k^2$

T(9.58E-03) = 251 T(0.02265) = 400 T(0.03341) = 499

std error est = 0.6 max error est = 2.5

OXYGEN O_2 100-1000K

$k(T) = -7.6727798E-04 + 1.03560076E-04T - 4.62034365E-08T^2 + 1.51980292E-11T^3$

k(100) = 9.14E-03 k(600) = 0.04802 k(1000) = 0.07179

std error est = 9E-05 max error est = 2E-04

1000-1500K

$k(T) = -0.18654526 + 7.05649428E-04T - 7.71025034E-07T^2 + 4.02143777E-10T^3 - 7.84907953E-14T^4$

k(1000) = 0.07173 k(1250) = 0.0846 k(1500) = 0.097

std error est = 2E-05 max error est = 1E-04

100-1000K

$T(k) = 11.465 + 9137.13572k + 65064.9850077k^2$

T(9.14E-03) = 100 T(0.04802) = 600 T(0.07179) = 1003

std error est = 1.2 max error est = 3.5

1000-1500K

$T(k) = -212.8193 + 14703.836485k + 30477.8067k^2$

T(0.07173) = 999 T(0.0846) = 1249 T(0.097) = 1500

std error est = 1.0 max error est = 2.5

---

n-PENTANE C_5H_{12} 250-500K

$k(T) = -6.17042124E-03 + 5.06949328E-05T + 6.81013431E-08T^2$

k(250) = 0.01076 k(375) = 0.02242 k(500) = 0.0362

std error est = 3.2E-05 max error est = 1E-04

Note: Pressure dependence between 250-300K ignored.

250-500K

$T(k) = 120.404 + 12797.2192k - 64302.207166k^2$

T(0.01076) = 251 T(0.02242) = 375 T(0.0362) = 499

std error est = 0.4 max error est = 2.5

PROPANE C_3H_8 200-500K

$k(T) = -1.07682209E-02 + 8.38590352E-05T + 4.22059864E-08T^2$

k(200) = 7.69E-03 k(350) = 0.02375 k(500) = 0.04171

std error est = 3.6E-05 max error est = 1E-04

PROPANE (continued) 200-500K

$T(k) = 123.418 + 10224.285427k - 28865.4345095k^2$

T(7.69E-03) = 200 T(0.02375) = 350 T(0.04171) = 500

std error est = 0.4 max error est = 2.0

RADON Rn 200-1000K

$k(T) = -8.228225E-05 + 1.2546552E-05T + 7.9101118E-10T^2 - 5.2693994E-12T^3 + 2.42034894E-15T^4$

k(200) = 2.52E-03 k(600) = 6.91E-03 k(1000) = 0.01041

std error est = 1.5E-05 max error est = 1E-04

200-1000K

$T(k) = 37.13 + 61362.656052k + 2966201.713917k^2$

T(2.52E-03) = 211 T(6.91E-03) = 603 T(0.01041) = 997

std error est = 2.5 max error est = 11.5

SULFUR DIOXIDE SO_2 270-900K

$k(T) = -1.86270694E-02 + 3.19110134E-04T - 1.73644245E-06T^2 + 5.09847985E-09T^3 - 7.53585825E-12T^4 + 5.48078289E-15T^5 - 1.56355469E-18T^6$

k(270) = 8.51E-03 k(550) = 0.02285 k(900) = 0.03998

std error est = 1E-04 max error est = 3E-04

270-900K

$T(k) = 72.882 + 27366.02837k - 431142.085k^2 + 6765624.30409k^3$

T(8.51E-03) = 279 T(.02285) = 554 T(0.03998) = 910

std error est = 4.5 max error est = 11.5

TOLUENE C_7H_8 250-600K

$k(T) = 5.33882E-02 - 4.90263636E-04T + 1.84066272E-06T^2 - 2.5107707E-09T^3 + 1.28558132E-12T^4$

k(250) = 0.01165 k(450) = 0.02943 k(600) = 0.04615

std error est = 4.9E-05 max error est = 1E-04

250-600K

$T(k) = 49.184 + 21881.4208k - 392934.468835k^2 + 3878149.983735k^3$

T(0.01165) = 257 T(0.02943) = 452 T(0.04615) = 603

std error est = 2.5 max error est = 8.0

TRICHLOROFLUOROMETHANE CCl_3F 250-500K

(FREON-11)

$k(T) = -4.57326E-03 + 4.23785103E-05T - 2.44200245E-09T^2$

k(250) = 5.87E-03 k(400) = 0.01199 k(500) = 0.01601

std error est = 2.5E-05 max error est = 1E-04

Note: Pressure dependence between 250-300K ignored.

250-500K

$T(k) = 108.8 + 23844.731142k + 37285.038633k^2$

T(5.87E-03) = 250 T(0.01199) = 400 T(0.01601) = 500

std error est = 0.7 max error est = 1.5

TRICHLOROTRIFLUORO- $C_2Cl_3F_3$ 250-400K
ETHANE (FREON-113)

$k(T) = 6.2276996E-03 - 3.53066526E-05T + 1.33788515E-07T^2$

k(250) = 5.76E-03 k(350) = 0.01026 k(400) = 0.01351
std error est = 2.1E-05 max error est = 1E-04
Note:Pressure dependence between 250-320K ignored.

250-400K

$T(k) = -22.79 + 68493.0493k - 4352430.586665k^2 + 118681269.374k^3$

T(5.76E-03) = 250 T(0.01026) = 350 T(0.01351) = 401
std error est = 0.6 max error est = 1.5

WATER (STEAM) H_2O 280-900K

$k(T) = -2.65056964E-02 + 3.1147143E-04T - 9.84019456E-07T^2 + 1.92787663E-09T^3 - 1.68859732E-12T^4 + 5.48194497E-16T^5$

k(280) = 0.01644 k(500) = 0.0358 k(900) = 0.078
std error est = 1.6E-04 max error est = 3E-04

280-900K

$T(k) = 28.726 + 17529.1632k - 157109.059k^2 + 971929.43672k^3$

T(0.01644) = 279 T(0.0358) = 500 T(0.078) = 901
std error est = 1.6 max error est = 3.5

XENON Xe 200-750K

$k(T) = 1.355426E-06 + 2.03984913E-05T - 5.53807454E-09T^2$

k(200) = 3.86E-03 k(500) = 8.82E-03 k(750) = 0.01219
std error est = 3.9E-06 max error est = 1E-04

200-750K

$T(k) = 23.4897 + 40124.516223k + 1585115.24618k^2$

T(3.86E-03) = 202 T(8.82E-03) = 501 T(0.01219) = 748
std error est = 1.0 max error est = 2.5

APPENDIX C
TABLE C-I
SUMMARY OF CONTENTS

DYNAMIC VISCOSITY (x 1E-06) OF
GASEOUS ELEMENTS AND COMPOUNDS

TABLE C-I
(CONT.)

NAME	FORMULA	APP C PAGE
Hydrogen Sulfide	H_2S	C-9
Iodine	I_2	C-9
Krypton	Kr	C-9
Methane	CH_4	C-10
Methyl Alcohol	CH_3OH	C-10
Methyl Chloride	CH_3Cl	C-10
Neon	Ne	C-10
Nitric Oxide	NO	C-11
Nitrogen	N_2	C-11
Nitrogen Peroxide	NO_2	C-11
Nitrous Oxide	N_2O	C-11
Octafluorocyclobutane	C_4F_8	C-12
n-Octane	C_8H_{18}	C-12
Oxygen	O_2	C-12
n-Pentane	C_5H_{12}	C-12
Propane	C_3H_8	C-12
Propylene	C_3H_6	C-13
Sulfur Dioxide	SO_2	C-13
Toluene	C_7H_8	C-13
Trichlorofluoromethane (FREON-11)	CCl_3F	C-13
Trichlorotrifluoroethane (FREON-113)	$C_2Cl_3F_3$	C-13
Trifluoromethane	CHF_3	C-14
Water	H_2O	C-14
Xenon	Xe	C-14

APPENDIX C
FORMAT EXAMPLE

The equations presented are for gaseous Acetylene

The polynomial equation to calculate the dynamic viscosity (μ) in N s/m^2 as a function of temperature (Kelvin)

Using the polynomial presented, the calculated dynamic viscosity at 600K is 19.12E-06 N s/m^2

Over the temperature range noted, the maximum estimated error is ±0.01E-06N s/m^2.

	Formula	Valid temperature range
ACETYLENE	C_2H_2	270-600K

$\mu(T) = -0.4486325 + 3.92559E\text{-}02T - 1.1077158E\text{-}05T^2$

$\mu(270) = 9.34$ $\mu(400) = 13.48$ $\mu(600) = 19.12$

std error est = 4.04E-03 max error est = 0.01

$$T(\mu) = 31.82 + 21.5671447\mu + \underset{270\text{-}600K}{0.4252123\mu^2}$$

$T(9.34) = 270$ $T(13.48) = 400$ $T(19.12) = 600$

std error est = 0.3 max error est = 1.5

standard (or average) error estimate is ±0.3 degrees Kelvin

Using the polynomial presented, the calculated temperature for a given μ = 19.12E-06N s/m^2 is 600K.

The polynomial equation to calculate temperature (Kelvin) as a function of dynamic viscosity in N s/m^2

***Note: All of the values for dynamic viscosity (μ) MUST be multiplied by 1E-06.

FIGURE C-1

APPENDIX C

DYNAMIC VISCOSITY (x 1E-06) OF GASEOUS ELEMENTS AND COMPOUNDS

ACETONE C_3H_6O 250-650K

$\mu(T) = 3.996401 + 1.51018819E\text{-}03T + 4.44247E\text{-}05T^2 - 2.47973E\text{-}08T^3$

$\mu(250) = 6.76$ $\mu(400) = 10.12$ $\mu(650) = 16.94$

std error est = 1.906E-02 max error est = 0.04

250-650K

$T(\mu) = -191.27 + 84.748208\mu - 3.388215\mu^2 + 7.7871645E\text{-}02\mu^3$

$T(6.76) = 251$ $T(10.12) = 400$ $T(16.94) = 651$

std error est = 0.9 max error est = 2

ACETYLENE C_2H_2 270-600K

$\mu(T) = -0.4486325 + 3.92559E\text{-}02T - 1.1077158E\text{-}05T^2$

$\mu(270) = 9.34$ $\mu(400) = 13.48$ $\mu(600) = 19.12$

std error est = 4.04E-03 max error est = 0.01

270-600K

$T(\mu) = 31.82 + 21.5671447\mu + .42521234\mu^2$

$T(9.34) = 270$ $T(13.48) = 400$ $T(19.12) = 600$

std error est = 0.3 max error est = 1.5

AIR 80-600K

$\mu(T) = -0.98601 + 0.09080125T - 1.17635575E\text{-}04T^2 + 1.2349703E\text{-}07T^3 - 5.7971299E\text{-}11T^4$

$\mu(80) = 5.59$ $\mu(350) = 20.81$ $\mu(600) = 30.31$

std error est = 1.47E-02 max error est = 0.07

600-2000K

$\mu(T) = 4.8856745 + 5.43232E\text{-}02T - 2.4261775E\text{-}05T^2 + 7.9306E\text{-}09T^3 - 1.10398E\text{-}12T^4$

$\mu(600) = 30.32$ $\mu(1200) = 46.55$ $\mu(2000) = 62.27$

std error est = 1.98E-02 max error est = 0.05

80-600K

$T(\mu) = 23.211 + 8.59256\mu + 0.342764\mu^2$

$T(5.59) = 82$ $T(20.81) = 350$ $T(30.31) = 600$

std error est = 0.7 max error est = 1.5

600-2000K

$T(\ ) = 92.81 + 3.601092\mu + 0.43380968\mu^2$

$T(30.32) = 601$ $T(46.55) = 1200$ $T(62.27) = 1999$

std error est = 1.0 max error est = 2.5

AMMONIA NH_3 200-1000K

$\mu(T) = 0.3639 + 2.999278E\text{-}02T + 1.25282E\text{-}05T^2 - 7.033645E\text{-}09T^3$

$\mu(200) = 6.81$ $\mu(600) = 21.35$ $\mu(1000) = 35.85$

std error est = 3.57E-02 max error est = 0.08

AMMONIA (continued) 200-1000K

$T(\mu) = 20.22 + 27.09159\mu + 2.94502348E\text{-}03\mu^2$

T(6.81) = 205 T(21.35) = 600 T(35.85) = 995

std error est = 2.2 max error est = 5.0

ARGON Ar 60-540K

$\mu(T) = 1.22573 + 5.9456964E\text{-}02T + 1.897011E\text{-}04T^2 - 8.171242E\text{-}07T^3 + 1.2939183E\text{-}09T^4 - 7.5027442E\text{-}13T^5$

μ(60) = 5.32 μ(350) = 25.72 μ(540) = 35.55

std error est = 1.95E-02 max error est = 0.03

540-2200K

$\mu(T) = 4.03764 + 7.3665688E\text{-}02T - 3.3867E\text{-}05T^2 + 1.127158E\text{-}08T^3 - 1.585569E\text{-}12T^4$

μ(540) = 35.58 μ(1250) = 61.35 μ(2200) = 85.06

std error est = 0.03 max error est = 0.05

60-540K

$T(\mu) = 12.722 + 9.0267675\mu + 0.161221378\mu^2$

T(5.32) = 65 T(25.72) = 351 T(35.55) = 537

std error est = 1.7 max error est = 5.0

540-2200K

$T(\mu) = 108.244 + 3.305827\mu + 0.24958985\mu^2$

T(35.58) = 542 T(61.35) = 1250 T(85.06) = 2195

std error est = 1.1 max error est = 5.0

BENZENE C_6H_6 270-650K

$\mu(T) = 0.39324 + 2.24768E\text{-}02T + 8.090553E\text{-}06T^2 - 7.8349307E\text{-}09T^3$

μ(270) = 6.90 μ(400) = 10.18 μ(650) = 16.27

std error est = 0.02 max error est = 0.04

270-650K

$T(\mu) = 12.343 + 36.249\mu + 0.177428\mu^2$

T(6.90) = 272 T(10.18) = 400 T(16.27) = 649

std error est = 0.9 max error est = 2.0

BORON TRIFLUORIDE BF_3 190-700K

$\mu(T) = 1.401165 + 5.644982E\text{-}02T - 1.4088857E\text{-}05T^2$

μ(190) = 11.62 μ(400) = 21.73 μ(700) = 34.01

std error est = 1.9E-02 max error est = 0.03

190-700K

$T(\mu) = -38.33 + 19.737077\mu - 0.0468724\mu^2 + 3.08592457E\text{-}03\mu^3$

T(11.62) = 190 T(21.73) = 400 T(34.01) = 700

std error est = 0.5 max error est = 1.5

BROMINE Br_2 280-800K

$\mu(T) = 0.8027126 + 4.9413942E\text{-}02T - 1.70534854E\text{-}06T^2$

μ(280) = 14.50 μ(500) = 25.08 μ(800) = 39.24

std error est = 4.35E-02 max error est = 0.21

BROMINE (continued) 280-800K

$T(\mu) = -51.3 + 24.52145\mu - 0.153459363\mu^2 + 2.0985285E\text{-}03\mu^3$

T(14.50) = 278 T(25.08) = 500 T(39.24) = 801

std error est = 0.7 max error est = 1.5

BROMOTRIFLUOROMETHANE CF_3Br 230-500K

$\mu(T) = -1.62177 + 0.0694797T - 4.550649E\text{-}05T^2 + 2.0833526E\text{-}08T^3$

$\mu(230) = 12.20$ $\mu(350) = 18.01$ $\mu(500) = 24.35$

std error est = 0.02 max error est = 0.09

230-500K

$T(\mu) = 33.415 + 13.0473238\mu + 0.25127636\mu^2$

T(12.20) = 230 T(18.01) = 350 T(24.35) = 500

std error est = 0.4 max error est = 1.5

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iso-BUTANE $i\text{-}C_4H_{10}$ 270-520K

$\mu(T) = -0.102505 + 2.6972076E\text{-}02T - 4.2918193E\text{-}06T^2$

$\mu(270) = 6.87$ $\mu(400) = 10.00$ $\mu(520) = 12.76$

std error est = 6.5E-03 max error est = 0.02

270-520K

$T(\mu) = 7.628 + 35.967103\mu + 0.3272017\mu^2$

T(6.87) = 270 T(10.00) = 400 T(12.76) = 520

std error est = 0.3 max error est = 1.5

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n-BUTANE $n\text{-}C_4H_{10}$ 270-520K

$\mu(T) = -0.01099487 + 2.634504E\text{-}02T - 3.54700854E\text{-}06T^2$

$\mu(270) = 6.84$ $\mu(400) = 9.96$ $\mu(520) = 12.73$

std error est = 5.9E-03 max error est = 0.02

270-520K

$T(\mu) = 3.12 + 37.1408242\mu + 0.271992359\mu^2$

T(6.84) = 270 T(9.96) = 400 T(12.73) = 520

std error est = 0.3 max error est = 1.5

CARBON DIOXIDE CO_2 170-2000K

$\mu(T) = -0.8095191 + 6.0395329E\text{-}02T - 2.824853E\text{-}05T^2 + 9.843776E\text{-}09T^3 - 1.47315277E\text{-}12T^4$

$\mu(170) = 8.69$ $\mu(1100) = 42.39$ $\mu(2000) = 62.17$

std error est = 3E-02 max error est = 0.1

170-2000K

$T(\mu) = 25.166 + 15.2582\mu + 0.1780093719\mu^2 + 1.4129E\text{-}03\mu^3$

T(8.69) = 172 T(42.39) = 1099 T(62.17) = 2001

std error est = 1.3 max error est = 5.0

CARBON MONOXIDE CO 80-1500K

$\mu(T) = -0.524575 + 7.9606E\text{-}02T - 7.82295E\text{-}05T^2 + 6.2821488E\text{-}08T^3 - 2.83747E\text{-}11T^4 + 5.317831E\text{-}15T^5$

$\mu(80) = 5.37$ $\mu(800) = 35.38$ $\mu(1500) = 51.63$

CARBON MONOXIDE (continued)

std error est = 2.62E-02 max error est = 0.03

80-1500K

$T(\mu) = 21.08 + 10.0217\mu + 0.289517\mu^2 + 1.4002864E\text{-}03\mu^3$

T(5.37) = 83 T(35.38) = 800 T(51.63) = 1503

std error est = 1.3 max error est = 3.5

CARBON TETRACHLORIDE CCl_4 280-800K

$\mu(T) = -1.5110416 + 4.3798388E\text{-}02T - 2.02626E\text{-}05T^2 + 6.144E\text{-}09T^3$

μ(280) = 9.30 μ(550) = 17.47 μ(800) = 23.71

std error est = 2.2E-02 max error est = 0.04

280-800K

$T(\mu) = 53.258 + 19.890474\mu + 0.489386918\mu^2$

T(9.30) = 281 T(17.47) = 550 T(23.71) = 800

std error est = 0.9 max error est = 2.5

CARBON TETRAFLUORIDE CF_4 230-500K

$\mu(T) = -1.235676 + 7.815327E\text{-}02T - 6.115548E\text{-}05T^2 + 2.95168E\text{-}08T^3$

μ(230) = 13.86 μ(400) = 22.13 μ(500) = 26.24

std error est = 2.7E-03 max error est = 0.01

230-500K

$T(\mu) = 37.74 + 9.70199\mu + 0.30144808\mu^2$

T(13.86) = 230 T(22.13) = 400 T(26.24) = 500

std error est = 0.1 max error est = 1.0

CHLORINE Cl_2 270-800K

$\mu(T) = -1.81447 + 5.814046E\text{-}02T - 2.299287E\text{-}05T^2 + 5.015775E\text{-}09T^3$

μ(270) = 12.31 μ(550) = 24.04 μ(800) = 32.55

std error est = 0.08 max error est = 0.15

270-800K

$T(\mu) = 56.456 + 14.237878\mu + 0.262332581\mu^2$

T(12.31) = 271 T(24.04) = 550 T(32.55) = 798

std error est = 2.5 max error est = 5.0

CHLORODIFLUOROMETHANE $CHClF_2$ 250-500K

(FREON-22)

$\mu(T) = -0.7369597 + 4.9394676E\text{-}02T - 1.2112332E\text{-}05T^2$

μ(250) = 10.85 μ(400) = 17.08 μ(500) = 20.93

std error est = 0.02 max error est = 0.03

250-500K

$T(\mu) = 23.086 + 18.911\mu + 0.18471282\mu^2$

T(10.85) = 250 T(17.08) = 400 T(20.93) = 500

std error est = 0.3 max error est = 2.0

CHLOROFORM $CHCl_3$ 250-650K

$\mu(T) = -0.389489 + 3.6808E\text{-}02T - 2.72048E\text{-}06T^2 - 3.194456E\text{-}09T^3$

$\mu(250) = 8.59$ $\mu(450) = 15.33$ $\mu(650) = 21.51$

std error est = 0.022 max error est = 0.09

250-650K

$T(\mu) = 23.48 + 24.644568\mu + 0.207098\mu^2$

T(8.59) = 250 T(15.33) = 450 T(21.51) = 649

std error est = 0.8 max error est = 3.5

CHLOROPENTAFLUOROETHANE C_2ClF_5 250-500K

$\mu(T) = 0.357912 + 4.440886E\text{-}02T - 1.014652E\text{-}05T^2$

$\mu(250) = 10.83$ $\mu(400) = 16.50$ $\mu(500) = 20.03$

std error est = 3.5E-03 max error est = 0.01

250-500K

$T(\mu) = 0.2646 + 20.875165\mu + 0.203445135\mu^2$

T(10.83) = 250 T(16.50) = 400 T(20.03) = 500

std error est = 0.2 max error est = 1.0

CHLOROTRIFLUOROMETHANE $CClF_3$ 230-500K
(FREON-13)

$\mu(T) = 4.018574 + 2.3020865E\text{-}02T + 5.190552E\text{-}05T^2 - 4.09445E\text{-}08T^3$

$\mu(230) = 11.56$ $\mu(400) = 18.91$ $\mu(500) = 23.39$

std error est = 4.4E-03 max error est = 0.01

230-500K

$T(\mu) = -53.645 + 25.566055\mu - 8.24565722E\text{-}02\mu^2$

T(11.56) = 231 T(18.91) = 400 T(23.39) = 499

std error est = 0.5 max error est = 2.5

DEUTERIUM D_2 15-500K

$\mu(T) = -0.0374066 + 0.07422285T - 1.98491852E\text{-}04T^2 + 4.0366E\text{-}07T^3$
$- 3.18855544E\text{-}10T^4$

$\mu(15) = 1.03$ $\mu(300) = 12.68$ $\mu(500) = 17.98$

std error est = 4.5E-02 max error est = 0.09

15-500K

$T(\mu) = -0.449 + 13.1729602\mu + 0.8102567096\mu^2$

T(1.03) = 14 T(12.68) = 297 T(17.98) = 498

std error est = 1.6 max error est = 4.5

DICHLORODIFLUOROMETHANE CCl_2F_2 250-500K
(FREON-12)

$\mu(T) = -0.904423 + 5.03878E\text{-}02T - 1.7884615E\text{-}05T^2$

$\mu(250) = 10.57$ $\mu(400) = 16.39$ $\mu(500) = 19.82$

std error est = 5.3E-03 max error est = 0.01

DICHLORODIFLUOROMETHANE (continued) 250-500K

$T(\mu) = 38.998 + 16.2507676\mu + 0.3528873\mu^2$

T(10.57) = 250 T(16.39) = 400 T(19.82) = 500

std error est = 0.2 max error est = 1.5

DICHLOROFLUOROMETHANE $CHCl_2F$ 280-500K

(FREON-21)

$\mu(T) = 0.033118573 + 4.03724167E\text{-}02T - 5.7792208E\text{-}06T^2$

μ(280) = 10.88 μ(400) = 15.26 μ(500) = 18.77

std error est = 5.8E-03 max error est = 0.01

280-500K

$T(\mu) = 2.23 + 24.1579854\mu + 0.1253726\mu^2$

T(10.88) = 280 T(15.26) = 400 T(18.77) = 500

std error est = 0.2 max error est = 1.5

DICHLOROTETRAFLUOROETHANE $C_2Cl_2F_4$ 230-500K

(FREON-114)

$\mu(T) = 4.649332 + 9.784407E\text{-}03T + 5.818667E\text{-}05T^2 - 4.542242E\text{-}08T^3$

μ(230) = 9.43 μ(400) = 14.97 μ(500) = 18.41

std error est = 6.2E-03 max error est = 0.01

230-500K

$T(\mu) = -87.64 + 35.9444125\mu - 0.2222265\mu^2$

T(9.43) = 232 T(14.97) = 401 T(18.41) = 499

std error est = 0.7 max error est = 2.5

ETHANE C_2H_6 190-1000K

$\mu(T) = -0.5107728 + 3.76582E\text{-}02T - 1.59412113E\text{-}05T^2 + 3.906E\text{-}09T^3$

μ(190) = 6.10 μ(600) = 17.19 μ(1000) = 25.11

std error est = 3.3E-02 max error est = 0.03

190-1000K

$T(\mu) = 43.829 + 20.323073\mu + 0.7026353\mu^2$

T(6.10) = 194 T(17.19) = 601 T(25.11) = 997

std error est = 2.2 max error est = 4.5

ETHYL ALCOHOL C_2H_5OH 270-600K

$\mu(T) = -0.0633595 + 3.2071347E\text{-}02T - 6.25079576E\text{-}06T^2$

μ(270) = 8.14 μ(400) = 11.77 μ(600) = 16.93

std error est = 3.9E-03 max error est = 0.01

270-600K

$T(\mu) = 10.415 + 29.22028895\mu + 0.330513733\mu^2$

T(8.14) = 270 T(11.77) = 400 T(16.93) = 600

std error est = 0.2 max error est = 1.5

ETHYL ETHER $C_4H_{10}O$ 250-650K

$\mu(T) = -0.82017 + 2.98341946E\text{-}02T - 4.938627E\text{-}06T^2 - 2.82999E\text{-}09T^3$

μ(250) = 6.29 μ(450) = 11.35 μ(650) = 15.71

ETHYL ETHER (continued)

std error est = 0.02 max error est = 0.03

250-650K

$T(\mu) = 51.2 + 27.634314\mu + 0.6622779\mu^2$

T(6.29) = 251 T(11.35) = 450 T(15.71) = 649

std error est = 0.9 max error est = 3.5

ETHYLENE C_2H_4 190-1500K

$\mu(T) = -0.3919492 + 0.040557T - 1.6439973E\text{-}05T^2 + 3.7310454E\text{-}09T^3$

μ(190) = 6.75 μ(800) = 23.44 μ(1500) = 36.05

std error est = 2.6E-02 max error est = 0.05

190-1500K

$T(\mu) = 23.3 + 22.4670445\mu + 0.34307964\mu^2 + 4.8478305E\text{-}03\mu^3$

T(6.75) = 192 T(23.44) = 801 T(36.05) = 1506

std error est = 1.1 max error est = 6.5

FLUORINE F_2 90-500K

$\mu(T) = -1.3474535 + 0.1088684T - 1.032287E\text{-}04T^2 + 6.02076E\text{-}08T^3$

μ(90) = 7.66 μ(350) = 26.69 μ(500) = 34.81

std error est = 3E-02 max error est = 0.1

90-500K

$T(\mu) = 23.06 + 7.555066\mu + 0.176432568\mu^2$

T(7.66) = 91 T(26.69) = 350 T(34.81) = 500

std error est = 0.7 max error est = 2.5

HELIUM He 1-500K

$\mu(T) = 0.39414 + 0.17213335T - 1.38733E\text{-}03T^2 + 8.020045E\text{-}06T^3 - 2.4278655E\text{-}08T^4 + 3.641644E\text{-}11T^5 - 2.14117E\text{-}14T^6$

μ(1) = 0.56 μ(250) = 17.53 μ(500) = 28.17

std error est = 9.2E-02 max error est = 0.19

500-2500K

$\mu(T) = 7.442412 + 4.6649873E\text{-}02T - 1.0385665E\text{-}05T^2 + 1.35269E\text{-}09T^3$

μ(500) = 28.34 μ(1500) = 58.61 μ(2500) = 80.29

std error est = 4E-02 max error est = 0.09

1-500K

$T(\mu) = -2.78 + 4.7805365\mu + 0.702059\mu^2 - 8.7384854E\text{-}03\mu^3$

T(.56) = 0 T(17.53) = 250 T(28.17) = 494

std error est = 2.2 max error est = 7.0

500-2500K

$T(\mu) = -15.4944 + 11.26614\mu + 0.249906096\mu^2$

T(28.34) = 505 T(58.61) = 1503 T(80.29) = 2500

std error est = 1.9 max error est = 5.5

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n-HEPTANE C_7H_{16} 270-580K

n-HEPTANE (continued) 270-580K

$\mu(T) = 1.540097 + 1.095157E\text{-}02T + 1.800664E\text{-}05T^2 - 1.36379E\text{-}08T^3$

$\mu(270) = 5.54$ $\mu(400) = 7.93$ $\mu(580) = 11.29$

std error est = 3.1E-03 max error est = 0.01

270-580K

$T(\mu) = -31.9 + 55.191463\mu - 9.495688E\text{-}02\mu^2$

T(5.54) = 271 T(7.93) = 400 T(11.29) = 579

std error est = 0.6 max error est = 1.5

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n-HEXANE C_6H_{14} 270-900K

$\mu(T) = 1.545412 + 1.150809E\text{-}02T + 2.722165E\text{-}05T^2 - 3.269E\text{-}08T^3 + 1.245459E\text{-}11T^4$

$\mu(270) = 6.06$ $\mu(600) = 12.80$ $\mu(900) = 18.29$

std error est = 4.6E-03 max error est = 0.01

270-900K

$T(\mu) = -35.27 + 53.9008\mu - 0.760933\mu^2 + 3.349925E\text{-}02\mu^3$

T(6.06) = 271 T(12.80) = 600 T(18.29) = 901

std error est = 0.5 max error est = 2.0

HYDROGEN H_2 10-500K

$\mu(T) = -0.135666 + 6.84115878E\text{-}02T - 3.928747E\text{-}04T^2 + 1.8996E\text{-}06T^3 - 5.23104E\text{-}09T^4 + 7.4490972E\text{-}12T^5 - 4.250937E\text{-}15T^6$

$\mu(10) = 0.51$ $\mu(250) = 7.90$ $\mu(500) = 12.72$

std error est = 9.6E-03 max error est = 0.03

500-2000K

$\mu(T) = 2.72941 + 2.3224377E\text{-}02T - 7.6287854E\text{-}06T^2 + 2.92585E\text{-}09T^3 - 5.2889938E\text{-}13T^4$

$\mu(500) = 12.77$ $\mu(1250) = 24.26$ $\mu(2000) = 33.61$

std error est = 3.3E-02 max error est = 0.05

10-500K

$T(\mu) = -7.126 + 19.551451\mu + 1.6191086\mu^2$

T(0.51) = 3 T(7.90) = 248 T(12.72) = 503

std error est = 2.9 max error est = 7.0

500-2000K

$T(\mu) = -116.25 + 39.399135\mu + 0.69646657\mu^2$

T(12.77) = 500 T(24.26) = 1249 T(33.61) = 1995

std error est = 2.5 max error est = 6.0

HYDROGEN CHLORIDE HCl 250-650K

$(T) = -10.37895 + 0.146304667T - 3.3750673E\text{-}04T^2 + 5.204805E\text{-}07T^3 - 3.066023E\text{-}10T^4$

(250) = 12.04 (450) = 21.97 (650) = 30.33

std error est = 0.143 max error est = 0.25

HYDROGEN CHLORIDE (continued) 250-650K

$T(\mu) = 54.8 + 14.15333\mu + 0.17335227\mu^2$

T(12.04) = 250 T(21.97) = 449 T(30.33) = 644

std error est = 3.9 max error est = 7.5

HYDROGEN IODIDE HI 250-650K

$\mu(T) = -0.8210072 + 6.96502E\text{-}02T - 1.1987247E\text{-}05T^2$

$\mu(250) = 15.84$ $\mu(400) = 25.12$ $\mu(650) = 39.39$

std error est = 2.6E-02 max error est = 0.09

250-650K

$T(\mu) = 18.0 + 13.73048\mu + 5.8615567E\text{-}02\mu^2$

T(15.84) = 250 T(25.12) = 400 T(39.39) = 650

std error est = 0.6 max error est = 2.0

HYDROGEN SULFIDE H_2S 270-500K

$\mu(T) = -1.880078 + 5.29022575E\text{-}02T - 1.49125874E\text{-}05T^2$

$\mu(270) = 11.32$ $\mu(400) = 16.89$ $\mu(500) = 20.84$

std error est = 1.6E-02 max error est = 0.03

270-500K

$T(\mu) = 46.59 + 17.386465\mu + 0.2091804\mu^2$

T(11.32) = 270 T(16.89) = 400 T(20.84) = 500

std error est = 0.5 max error est = 1.5

IODINE I_2 370-700K

$\mu(T) = -9.77787 + 0.12652959T - 2.34192527E\text{-}04T^2 + 2.94743E\text{-}07T^3 - 1.409635E\text{-}10T^4$

$\mu(370) = 17.26$ $\mu(550) = 25.11$ $\mu(700) = 31.29$

std error est = 4E-02 max error est = 0.04

370-700K

$T(\mu) = 11.76 + 19.2390557\mu + 8.7220577E\text{-}02\mu^2$

T(17.26) = 370 T(25.11) = 550 T(31.29) = 699

std error est = 0.9 max error est = 2.5

KRYPTON Kr 100-1500K

$\mu(T) = -0.465233 + 9.9000315E\text{-}02T - 4.278998E\text{-}05T^2 + 1.9612E\text{-}09T^3 + 1.0362237E\text{-}11T^4 - 3.592904E\text{-}15T^5$

$\mu(100) = 9.01$ $\mu(800) = 55.42$ $\mu(1500) = 83.55$

std error est = 5.5E-02 max error est = 0.3

100-1500K

$T(\mu) = 15.03 + 9.1084\mu + 6.7458509E\text{-}02\mu^2 + 4.33414E\text{-}04\mu^3$

T(9.01) = 103 T(55.42) = 801 T(83.55) = 1500

std error est = 1.3 max error est = 6.5

METHANE CH_4 70-1000K

$\mu(T) = 0.2968267 + 3.711201E\text{-}02T + 1.218298E\text{-}05T^2 - 7.02426E\text{-}08T^3 + 7.543269E\text{-}11T^4 - 2.7237166E\text{-}14T^5$

$\mu(70) = 2.93$ $\mu(550) = 18.24$ $\mu(1000) = 27.54$

std error est = 3E-02 max error est = 0.09

70-1000K

$T(\mu) = 2.184 + 23.32102\mu + 0.179160065\mu^2 + 1.0455235E\text{-}02\mu^3$

$T(2.93) = 72$ $T(18.24) = 551$ $T(27.54) = 999$

std error est = 1.4 max error est = 3.5

METHYL ALCOHOL CH_3OH 250-650K

$\mu(T) = 1.1979 + 0.0245028T + 1.8616274E\text{-}05T^2 - 1.3067482E\text{-}08T^3$

$\mu(250) = 8.28$ $\mu(400) = 13.14$ $\mu(650) = 21.40$

std error est = 3.2E-02 max error est = 0.04

250-650K

$T(\mu) = -4.983 + 31.162925\mu - 2.8760994E\text{-}02\mu^2$

$T(8.28) = 251$ $T(13.14) = 400$ $T(21.40) = 649$

std error est = 1.1 max error est = 2.5

METHYL CHLORIDE CH_3Cl 250-660K

$\mu(T) = 0.282322 + 0.0364907T - 2.48976E\text{-}06T^2$

$\mu(250) = 9.25$ $\mu(400) = 14.48$ $\mu(660) = 23.28$

std error est = 2.4E-02 max error est = 0.04

250-660K

$T(\mu) = -6.86 + 27.202172\mu + 6.180147E\text{-}02\mu^2$

$T(9.25) = 250$ $T(14.48) = 400$ $T(23.28) = 660$

std error est = 0.7 max error est = 2.0

NEON Ne 20-450K

$\mu(T) = -0.261473 + 0.2007328T - 7.54726E\text{-}04T^2 + 2.5795522E\text{-}06T^3 - 4.7146844E\text{-}09T^4 + 3.3937307E\text{-}12T^5$

$\mu(20) = 3.47$ $\mu(250) = 27.95$ $\mu(450) = 41.59$

std error est = 4E-02 max error est = 0.09

450-1200K

$\mu(T) = 9.5675148 + 8.4038686E\text{-}02T - 3.2087447E\text{-}05T^2 + 7.366716E\text{-}09T^3$

$\mu(450) = 41.56$ $\mu(850) = 62.34$ $\mu(1200) = 76.94$

std error est = 2.9E-02 max error est = 0.06

20-450K

$T(\mu) = 0.08 + 4.9693056\mu + 0.141318424\mu^2$

$T(3.47) = 19$ $T(27.95) = 249$ $T(41.59) = 451$

std error est = 0.5 max error est = 2.5

NEON (continued) 450-1200K

$T(\mu) = -1.85 + 5.337484\mu + 0.1336294\mu^2$

T(41.56) = 451 T(62.34) = 850 T(76.94) = 1200

std error est = 0.6 max error est = 2.0

NITRIC OXIDE NO 110-1500K

$\mu(T) = -0.80134 + 8.61223E\text{-}02T - 8.053232E\text{-}05T^2 + 6.3144787E\text{-}08T^3 - 2.8327E\text{-}11T^4 + 5.325217E\text{-}15T^5$

μ(110) = 7.78 μ(800) = 39.03 μ(1500) = 57.33

std error est = 2.6E-02 max error est = 0.06

110-1500K

$T(\mu) = 22.84 + 9.70756\mu + 0.2197071\mu^2 + 1.0689525E\text{-}03\mu^3$

T(7.78) = 112 T(39.03) = 800 T(57.33) = 1503

std error est = 1.1 max error est = 3.5

NITROGEN N_2 80-2200K

$\mu(T) = 0.025465 + 7.5336535E\text{-}02T - 6.51566245E\text{-}05T^2 + 4.34945E\text{-}08T^3 - 1.5622457E\text{-}11T^4 + 2.249666E\text{-}15T^5$

μ(80) = 5.66 μ(1250) = 46.06 μ(2200) = 63.51

std error est = 3.9E-02 max error est = 0.11

80-2200K

$T(\mu) = 23.03 + 9.279727\mu + 0.3237956\mu^2 + 1.14361184E\text{-}03\mu^3$

T(5.66) = 86 T(46.06) = 1249 T(63.51) = 2211

std error est = 1.5 max error est = 11.0

NITROGEN PEROXIDE NO_2 300-450K

$\mu(T) = 785.544557 - 8.749203T + 3.6259252E\text{-}02T^2 - 6.5336018E\text{-}05T^3 + 4.3577125E\text{-}08T^4$

μ(300) = 13.02 μ(370) = 19.47 μ(450) = 24.09

std error est = 9.4E-02 max error est = 0.2

300-450K

$T(\mu) = 318.245 - 8.8194949\mu + 0.5945482\mu^2$

T(13.02) = 304 T(19.47) = 372 T(24.09) = 451

std error est = 2.7 max error est = 6.0

NITROUS OXIDE N_2O 180-1500K

$\mu(T) = -1.4347 + 6.345024E\text{-}02T - 3.307219E\text{-}05T^2 + 1.3455025E\text{-}08T^3 - 2.4171922E\text{-}12T^4$

μ(180) = 8.99 μ(800) = 34.06 μ(1500) = 52.50

std error est = 2.3E-02 max error est = 0.04

180-1500K

$T(\mu) = 30.57 + 15.037308\mu + 0.1758553\mu^2 + 1.3549377E\text{-}03\mu^3$

T(8.99) = 181 T(34.06) = 800 T(52.50) = 1501

std error est = 0.8 max error est = 2.5

OCTAFLUOROCYCLOBUTANE C_4F_8 270-440K

$\mu(T) = -21.702187 + 0.29705496T - 1.1162856E\text{-}03T^2 + 2.126056E\text{-}06T^3 - 1.53345928E\text{-}09T^4$

$\mu(270) = 10.82$ $\mu(350) = 13.67$ $\mu(440) = 16.52$

std error est = 1.2E-02 max error est = 0.15

270-440K

$T(\mu) = 51.767 + 13.95912177\mu + 0.574077\mu^2$

$T(10.82) = 270$ $T(13.67) = 350$ $T(16.52) = 439$

std error est = 0.6 max error est = 2.0

n-OCTANE C_8H_{18} 300-650K

$\mu(T) = 0.8324354 + 1.40045E\text{-}02T + 8.793765E\text{-}06T^2 - 6.8403E\text{-}09T^3$

$\mu(300) = 5.64$ $\mu(450) = 8.29$ $\mu(650) = 11.77$

std error est = 2.1E-02 max error est = 0.04

300-650K

$T(\mu) = -8.63 + 53.900825\mu + 0.167701848\mu^2$

$T(5.64) = 301$ $T(8.29) = 450$ $T(11.77) = 649$

std error est = 1.2 max error est = 3.5

OXYGEN O_2 80-2000K

$\mu(T) = -0.397863 + 8.7605894E\text{-}02T - 7.064124E\text{-}05T^2 + 4.6287E\text{-}08T^3 - 1.690435E\text{-}11T^4 + 2.534147E\text{-}15T^5$

$\mu(80) = 6.18$ $\mu(1100) = 51.43$ $\mu(2000) = 73.17$

std error est = 3.1E-02 max error est = 0.08

80-2000K

$T(\mu) = 19.02 + 9.362836\mu + 0.185555\mu^2 + 7.899354E\text{-}04\mu^3$

$T(6.18) = 84$ $T(51.43) = 1099$ $T(73.17) = 2007$

std error est = 1.5 max error est = 7.0

n-PENTANE C_5H_{12} 270-550K

$\mu(T) = 0.2416119 + 2.307305E\text{-}02T - 1.52727E\text{-}06T^2$

$\mu(270) = 6.36$ $\mu(400) = 9.23$ $\mu(550) = 12.47$

std error est = 8.2E-03 max error est = 0.02

270-550K

$T(\mu) = -9.73 + 43.0470668\mu + 0.14747898\mu^2$

$T(6.36) = 270$ $T(9.23) = 400$ $T(12.47) = 550$

std error est = 0.4 max error est = 1.5

PROPANE C_3H_8 270-600K

$\mu(T) = -0.3543711 + 3.080096E\text{-}02T - 6.99723E\text{-}06T^2$

$\mu(270) = 7.45$ $\mu(450) = 12.09$ $\mu(600) = 15.61$

std error est = 5.9E-03 max error est = 0.01

PROPYLENE C_3H_6 210-360K

$\mu(T) = -1.1116324 + 0.03663067T - 1.2184874E\text{-}05T^2$

$\mu(210) = 6.04$ $\mu(300) = 8.78$ $\mu(360) = 10.50$

std error est = 4.4E-03 max error est = 0.01

210-360K

$T(\mu) = 36.1 + 25.971212587\mu + 0.4652205\mu^2$

T(6.04) = 210 T(8.78) = 300 T(10.50) = 360

std error est = 0.2 max error est = 1.5

SULFUR DIOXIDE SO_2 200-1250K

$\mu(T) = -1.141748 + 0.051281456T - 1.3886282E\text{-}05T^2 + 2.15266E\text{-}09T^3$

$\mu(200) = 8.58$ $\mu(650) = 26.92$ $\mu(1250) = 45.47$

std error est = 3.7E-02 max error est = 0.08

200-1250K

$T(\mu) = 43.076 + 16.9625\mu + 0.20754597\mu^2$

T(8.58) = 204 T(26.92) = -50 T(45.47) = 1243

std error est = 2.2 max error est = 9.0

TOLUENE C_7H_8 330-550K

$\mu(T) = -2.2639265 + 3.8294535E\text{-}02T - 2.9042466E\text{-}05T^2 + 1.6824E\text{-}08T^3$

$\mu(330) = 7.82$ $\mu(450) = 10.62$ $\mu(550) = 12.81$

std error est = 2E-02 max error est = 0.04

330-550K

$T(\mu) = 42.866 + 32.181384\mu + 0.579136617\mu^2$

T(7.82) = 330 T(10.62) = 450 T(12.81) = 550

std error est = 0.9 max error est = 2.0

TRICHLOROFLUOROMETHANE CCl_3F 230-500K
(FREON-11)

$\mu(T) = 4.6926597 + 5.81068E\text{-}03T + 6.427175E\text{-}05T^2 - 4.712105E\text{-}08T^3$

$\mu(230) = 8.86$ $\mu(400) = 14.28$ $\mu(500) = 17.78$

std error est = 6E-03 max error est = 0.01

230-500K

$T(\mu) = -188.137 + 63.015166\mu - 2.19224063\mu^2 + 4.64365E\text{-}02\mu^3$

T(8.86) = 230 T(14.28) = 400 T(17.78) = 500

std error est = 0.3 max error est = 1.5

TRICHLOROTRIFLUOROETHANE $C_2Cl_3F_3$ 230-400K
(FREON-113)

$\mu(T) = 1.5959133 + 3.483849E\text{-}02T - 1.8833849E\text{-}05T^2$

$\mu(230) = 8.61$ $\mu(350) = 11.48$ $\mu(400) = 12.52$

std error est = 4.9E-03 max error est = 0.01

230-400K

$T(\mu) = 23.38 + 10.69495544\mu + 1.547242767\mu^2$

T(8.61) = 230 T(11.48) = 350 T(12.52) = 400

std error est = 0.3 max error est = 2.0

TRIFLUOROMETHANE CHF_3 230-500K

$\mu(T) = -2.100796 + 6.3910783E\text{-}02T - 2.41926655E\text{-}05T^2$

$\mu(230) = 11.32$ $\mu(400) = 19.59$ $\mu(500) = 23.81$

std error est = 5.7E-03 max error est = 0.01

230-500K

$T(\mu) = 52.246 + 12.98628777\mu + 0.243660334\mu^2$

$T(11.32) = 230$ $T(19.59) = 400$ $T(23.81) = 500$

std error est = 0.2 max error est = 1.5

WATER H_2O 280-1000K

$\mu(T) = -3.07514683 + 4.069249E\text{-}02T + 5.20585924E\text{-}09T^2$

$\mu(280) = 8.32$ $\mu(650) = 23.38$ $\mu(1000) = 37.62$

std error est = 3.3E-03 max error est = 0.01

280-1000K

$T(\mu) = 75.57 + 24.574084\mu - 7.7339827E\text{-}05\mu^2$

$T(8.32) = 280$ $T(23.38) = 650$ $T(37.62) = 1000$

std error est = 0.08 max error est = 1.0

XENON Xe 120-1500K

$\mu(T) = 1.89178728 + 6.0506328E\text{-}02T + 8.1793523E\text{-}05T^2 - 2.051E\text{-}07T^3$
$+ 2.0164963E\text{-}10T^4 - 9.5234E\text{-}14T^5 + 1.7662669E\text{-}17T^6$

$\mu(120) = 10.02$ $\mu(800) = 53.65$ $\mu(1500) = 83.33$

std error est = 4.2E-02 max error est = 0.07

120-1500K

$T(\mu) = 7.02702 + 11.3664655\mu + 0.0360854\mu^2 + 5.165008E\text{-}04\mu^3$

$T(10.02) = 125$ $T(53.65) = 800$ $T(83.33) = 1504$

std error est = 1.5 max error est = 4.5

APPENDIX D
TABLE D-I
SUMMARY OF CONTENTS

THE VIRIAL COEFFICIENTS
FOR GASEOUS ELEMENTS AND COMPOUNDS

APPENDIX D
FORMAT EXAMPLE

The equation/s is for gaseous Neon

The polynomial equation to calculate the SECOND virial coefficient [B(T)] in cm^3/mol as a function of temperature (Kelvin)

Using the polynomial presented, the calculated second virial coefficient at 200K is 7.60 cm^3/mol.

Over the temperature range noted, the maximum error est is ±0.08 cm^3/mol.

	Formula	Valid Temperature Range
NEON	Ne	80-200K

$B(T) = -108.0286 + 2.354366T - 2.011992E\text{-}02T^2 + 8.1876808E\text{-}05T^3 - 1.28414363E\text{-}07T^4$

B(80) = -11.79 B(140) = 2.57 B(200) = 7.60

std error est = 0.04 max error est = 0.08

The standard (or average) error estimate over the temperature range noted is ±0.04 cm^3/mol.

FIGURE D-1

APPENDIX D

SECOND VIRIAL COEFFICIENTS FOR GASEOUS ELEMENTS AND COMPOUNDS

AIR (Dry, CO_2-Free) 100-150K

$$B(T) = -1502.0253 + 31.45448274T - 0.279362289T^2 + 1.1746791E\text{-}03T^3 - 1.91779611E\text{-}06T^4$$

B(100) = -167.30 B(125) = -109.17 B(150) = -75.85
std error est = 4.3E-02 max error est = 0.1

150-350K

$$B(T) = -871.7496 + 14.673657T - 0.1155472T^2 + 5.15056917E\text{-}04T^3 - 1.32633153E\text{-}06T^4 + 1.84350813E\text{-}09T^5 - 1.0723866E\text{-}12T^6$$

B(150) = -75.88 B(250) = -19.77 B(350) = 0.42
std error est = 0.2 max error est = 0.6

350-1400K

$$B(T) = -113.0307 + 0.6191348T - 1.1961097E\text{-}03T^2 + 1.2117027E\text{-}06T^3 - 6.19795E\text{-}10T^4 + 1.2599233E\text{-}13T^5$$

B(350) = 0.53 B(800) = 24.75 B(1400) = 31.21
std error est = 0.092 max error est = 0.35

ARGON Ar 80-250K

$$B(T) = -2602.5842 + 71.103308T - 0.8814188T^2 + 5.9930164E\text{-}03T^3 - 2.3043749E\text{-}05T^4 + 4.704073E\text{-}08T^5 - 3.96383723E\text{-}11T^6$$

std error est = 0.35 B(200) = -48.36 max error est = 0.9

250-1500K

$$B(T) = -195.60895 + 1.2604989T - 3.370398E\text{-}03T^2 + 4.9626165E\text{-}06T^3 - 4.0932672E\text{-}09T^4 + 1.76812575E\text{-}12T^5 - 3.1081026E\text{-}16T^6$$

B(250) = -27.93 B(700) = 15.23 B(1500) = 24.79
std error est = 0.16 max error est = 0.4

CARBON DIOXIDE CO_2 250-1000K

$$B(T) = -1495.9175 + 11.9968622T - 4.31032436E\text{-}02T^2 + 8.501674E\text{-}05T^3 - 9.4651135E\text{-}08T^4 + 5.57671E\text{-}11T^5 - 1.3516095E\text{-}14T^6$$

B(250) = -180.84 B(700) = -1.08 B(1000) = 14.31
std error est = 0.35 max error est = 1.0

DEUTERIUM D_2 85-420K

$$B(T) = -104.569 + 2.1780589T - 1.84434317E\text{-}02T^2 + 8.7373826E\text{-}05T^3 - 2.36196123E\text{-}07T^4 + 3.3976588E\text{-}10T^5 - 2.0138934E\text{-}13T^6$$

B(85) = -9.93 B(300) = 13.66 B(420) = 15.45
std error est = 0.7 max error est = 0.2

HELIUM He 20-200K

$B(T) = -34.55944 + 2.7175236T - 7.238207E\text{-}02T^2 + 1.0230434E\text{-}03T^3 - 7.80158414E\text{-}06T^4 + 3.01349506E\text{-}08T^5 - 4.60368796E\text{-}11T^6$

B(20) = -2.13 B(100) = 11.57 B(200) = 12.30

std error est = 0.14 max error est = 0.25

275-1400K

$B(T) = 16.797 - 2.974167E\text{-}02T + 5.9985787E\text{-}05T^2 - 6.536E\text{-}08T^3 + 3.4774704E\text{-}11T^4 - 7.17233967E\text{-}15T^5$

B(275) = 11.98 B(600) = 10.38 B(1400) = 8.40

std error est = 0.04 max error est = 0.09

HYDROGEN H_2 25-100K

$B(T) = -552.3468 + 37.9672515T - 1.2583684T^2 + 2.3661885E\text{-}02T^3 - 2.55707365E\text{-}04T^4 + 1.479355E\text{-}06T^5 - 3.547909E\text{-}09T^6$

B(25) = -106.23 B(50) = -33.48 B(100) = -2.52

std error est = 0.1 max error est = 0.25

120-420K

$B(T) = -28.6784 + 0.2390086T + 1.6559E\text{-}03T^2 - 2.0165055E\text{-}05T^3 + 7.74730172E\text{-}08T^4 - 1.3371575E\text{-}10T^5 + 8.80146735E\text{-}14T^6$

B(120) = 2.00 B(350) = 15.32 B(420) = 16.11

std error est = 0.04 max error est = 0.1

KRYPTON Kr 125-200K

$B(T) = -3767.455 + 79.33045T - 0.7427849T^2 + 3.65588424E\text{-}03T^3 - 9.2488483E\text{-}06T^4 + 9.5193755E\text{-}09T^5$

B(125) = -284.18 B(160) = -178.36 B(200) = -117.39

std error est = 0.03 max error est = 0.1

200-400K

$B(T) = -1195.697 + 14.577052T - 8.36262E\text{-}02T^2 + 2.714544E\text{-}04T^3 - 5.095532E\text{-}07T^4 + 5.16988543E\text{-}10T^5 - 2.19801246E\text{-}13T^6$

B(200) = -117.62 B(300) = -51.00 B(400) = -22.89

std error est = 0.04 max error est = 0.1

400-1500K

$B(T) = -285.26 + 1.490866T - 3.3921494E\text{-}03T^2 + 4.3542916E\text{-}06T^3 - 3.1988343E\text{-}09T^4 + 1.253671E\text{-}12T^5 - 2.030971E\text{-}16T^6$

B(400) = -22.87 B(800) = 13.17 B(1500) = 27.00

std error est = 0.05 max error est = 0.1

METHANE CH_4 110-200K

$B(T) = -4564.8011 + 108.37155T - 1.1344657T^2 + 6.2125655E\text{-}03T^3 - 1.742442E\text{-}05T^4 + 1.9820625E\text{-}08T^5$

B(110) = -333.94 B(160) = -161.93 B(200) = -105.07

std error est = 0.04 max error est = 0.1

METHANE (continued) 200-400K

$B(T) = -1161.958 + 14.527312T - 8.4895E\text{-}02T^2 + 2.7964493E\text{-}04T^3 - 5.300204E\text{-}07T^4 + 5.396463E\text{-}10T^5 - 2.28570436E\text{-}13T^6$

B(200) = -105.11 B(300) = -42.35 B(400) = -15.73

std error est = 0.04 max error est = 0.07

400-1500K

$B(T) = -263.0827 + 1.39774T - 3.15891435E\text{-}03T^2 + 4.03489206E\text{-}06T^3 - 2.954616E\text{-}09T^4 + 1.155816E\text{-}12T^5 - 1.87089616E\text{-}16T^6$

B(400) = -15.75 B(900) = 22.15 B(1500) = 31.90

std error est = 0.06 max error est = 0.15

NEON Ne 80-200K

$B(T) = -108.0286 + 2.354366T - 2.011992E\text{-}02T^2 + 8.1876808E\text{-}05T^3 - 1.28414363E\text{-}07T^4$

B(80) = -11.79 B(140) = 2.57 B(200) = 7.60

std error est = 0.04 max error est = 0.08

200-1000K

$B(T) = -18.52 + 0.253489T - 8.9773E\text{-}04T^2 + 1.76985156E\text{-}06T^3 - 1.98866447E\text{-}09T^4 + 1.1902623E\text{-}12T^5 - 2.9438917E\text{-}16T^6$

B(200) = 7.61 B(600) = 13.77 B(1000) = 14.30

std error est = 0.03 max error est = 0.05

NITROGEN N_2 100-150K

$B(T) = -1934.0 + 49.775958T - 0.5771643T^2 + 3.5473302E\text{-}03T^3 - 1.12452359E\text{-}05T^4 + 1.45225962E\text{-}08T^5$

B(100) = -159.85 B(125) = -103.84 B(150) = -71.41

std error est = 0.05 max error est = 0.09

150-325K

$B(T) = -1038.812 + 19.7330247T - 0.17557828T^2 + 8.834965E\text{-}04T^3 - 2.567272E\text{-}06T^4 + 4.0252916E\text{-}09T^5 - 2.6402379E\text{-}12T^6$

B(150) = -71.65 B(230) = -23.12 B(325) = -0.36

std error est = 0.04 max error est = 0.09

325-1400K

$B(T) = -156.96 + 1.0434304T - 2.717715E\text{-}03T^2 + 3.9752575E\text{-}06T^3 - 3.3108834E\text{-}09T^4 + 1.462975E\text{-}12T^5 - 2.65735587E\text{-}16T^6$

B(325) = -0.39 B(800) = 27.37 B(1400) = 33.50

std error est = 0.05 max error est = 0.1

OXYGEN O_2 100-200K

$B(T) = -2793.674 + 78.48548T - 1.0166435T^2 + 7.34716756E\text{-}03T^3 - 3.052873E\text{-}05T^4 + 6.8392904E\text{-}08T^5 - 6.4137155E\text{-}11T^6$

B(100) = -197.47 B(150) = -90.79 B(200) = -49.99

std error est = 0.035 max error est = 0.08

OXYGEN (continued) 200-400K

$B(T) = -499.657 + 5.4925876T - 2.7027447E\text{-}02T^2 + 7.1352086E\text{-}05T^3 - 9.750388E\text{-}08T^4 + 5.4294996E\text{-}11T^5$

B(200) = -50.05 B(300) = -15.69 B(400) = -0.60

std error est = 0.03 max error est = 0.05

400-1400K

$B(T) = -165.1965 + 1.0063385T - 2.541077E\text{-}03T^2 + 3.630033E\text{-}06T^3 - 2.9679937E\text{-}09T^4 + 1.29213468E\text{-}12T^5 - 2.318393E\text{-}16T^6$

B(400) = -0.61 B(900) = 21.01 B(1400) = 25.90

std error est = 0.02 max error est = 0.05

WATER VAPOR H_2O 430-720K

$B(T) = -39636.088 + 319.317424T - 1.039708598T^2 + 1.69863388E\text{-}03T^3 - 1.38836432E\text{-}06T^4 + 4.53516028E\text{-}10T^5$

B(430) = -316.78 B(530) = -147.27 B(720) = -96.19

std error est = 0.6 max error est = 1.3

'HEAVY' WATER VAPOR D_2O 430-720K

$B(T) = -40275.7499 + 324.5981063T - 1.057308467T^2 + 1.7280874E\text{-}03T^3 - 1.41303458E\text{-}06T^4 + 4.6177338E\text{-}10T^5$

B(430) = -320.24 B(550) = -133.22 B(720) = -56.19

std error est = 0.6 max error est = 1.5

XENON Xe 220-500K

$B(T) = -2694.3436 + 32.305283T - 0.181532587T^2 + 5.744002E\text{-}04T^3 - 1.04996174E\text{-}06T^4 + 1.03791638E\text{-}09T^5 - 4.30480244E\text{-}13T^6$

B(200) = -230.65 B(400) = -69.84 B(550) = -31.53

std error est = 0.05 max error est = 0.1

500-1500K

$B(T) = -490.2594 + 2.20020277T - 4.4278794E\text{-}03T^2 + 5.059897E\text{-}06T^3 - 3.3321925E\text{-}09T^4 + 1.17879258E\text{-}12T^5 - 1.735293E\text{-}16T^6$

B(500) = -38.78 B(1000) = 15.03 B(1500) = 30.09

std error est = 0.05 max error est = 0.1

TABLE D-II

THE THIRD VIRIAL COEFFICIENTS OF GASEOUS ELEMENTS AND COMPOUNDS*

T, K	He	Ne	Ar	Kr	Xe	N_2	O_2	Air	H_2	D_2	H_2O	D_2O	CO_2	CH_4
25									14					
30									16					
35									14.3					
40									12.1					
45									10.7					
50									9.6					
55									8.9					
60	2.7	4							8.4					
70	2.5	4							7.4					
80	2.4	4	7						6.9					
90	2.3	4	9						6.4					
100	2.2	4	12						6.1	6				
110	2.1	3	16						5.9	5				
120	2.0	3	20						5.7	5				
130	1.9	3	23						5.5	5				
140	1.8	3	25					28	5.4	5				
150	1.7	3	23					26	5.3	5				
160	1.6	3	22			26	23	24	5.2	5				
180	1.5	3	20			21	20	21	5.0	5				
200	1.3	3	18			19	17	19	4.8	5				
220	1.2	3	16	33		17	15	18	4.6	5				
240	1.1	3	15	30		16	13	17	4.5	5				
260	1.1	3	13	28		15	12	16	4.4	5				
273	1.1	3	12	27	62	15	11	15	4.2	5			57	29
280	1.0	3	12	26	59	15	11	15	4.1	5			56	28
300	1.0	2	11	24	54	14	10	15	3.9	5			52	26
320	1.0	2	11	23	50	14		14	3.6	5			49	25
340	.9	2	10	21	46	14		14	3.4	5			45	24
360	.8	2	9	20	41	13			3.2	5			42	22
380	.8	2	9	19	36	13			3.0	4			38	19
400	.7	2	9	18	34	13			2.9	4			36	17
420	.7		9	18	32	12				3			32	16
440			8	17	30	12								15
460			8	16	28	12								14
480			8	16	26	12								14
500			7	15	24	12					-100	-150		14
525			7	15	22						-53	-64		12
550			7	14	20						-17	-20		12
575			7	14	18						+2	0		11
600			7	13							9	8		11
650				13							12	12		
700				12							10	12		

*Units: 100 cm^6/mol^2

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